Pulsair Desktop

Service Manual

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Pulsair Desktop – Service Manual

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Introduction

Operator point of view

For simplicity all instructions in this manual are given from the point of view of an operator in normal use (even if the Pulsair Desktop is actually lying on its side) :

- Front, or forwards – is towards the patient
- Back, or backwards – is towards the operator
- Left, or left-side – is the operator's left
- Right, or right-side – is the operator's right
- Down, or downwards – is towards the *Base Plate*
- Up, or upwards – is away from the *Base Plate*

Any instruction referring to the left-side of the Pulsair Desktop means the left-side of the Pulsair Desktop from the point of view of an operator during normal use.

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Field servicing

Servicing steps

While the basic servicing steps may be possible

Before servicing the Pulsair Desktop you must get access to the *Base Unit* sub-assemblies by following Accessing the Base Unit sub-assemblies (page 10), and turning the *Head Unit*.

Test firing

Test firing the Pulsair Desktop will give you some idea about its current state.

Clean optics

Check the Regulator's output pressure

- Disconnect air-line between Regulator, and *Air Filter* at the Regulator end
- Connect your test air-line to the Regulator
- Switch on the Pulsair Desktop
- Take reading

Change the Air Filter

Check Calibration / Recalibrate

Calibration

Calibration overview

The Pulsair Desktop is connected to your laptop through a calibration unit – which has the following 3 serial port connectors :

- 1 – 9-pin port connected to an external pressure transducer
- 1 – 9-pin port connected to the Pulsair Desktop
- 1 – 15-pin serial port connector which splits in to two 9-pin serial ports connecting to your laptop

Connecting

- Connect the external pressure transducer to port on the *Calibration Unit* labelled *Pressure Transducer*
- Connect the Pulsair Desktop to the port on the *Calibration Unit* labelled *Tonometer Port*
- Connect the *Calibration Unit* using the15-pin connector to the host PC via the two 9 pin serial port connectors.
- Switch on the Pulsair Desktop with the pump switched off
- Run the Pulsair Desktop calibration software

Calibration

The Pulsair Desktop calibration software guides you through the process. For detailed instructions refer to Appendix A.

Troubleshooting

General

Low readings

When the display shows >25 – low pressure – the Pulsair Desktop will switch to hard puff.

High, or out of range readings

When the display shows >50 or < 5 – out of range – restart the readings process. High or low readings can be caused by patients partially closing the eye as the Pulsair Desktop fires.

Customer complaints …

It doesn't work

This may be caused by the device not getting power.

Checks & solutions

- Check the power supply is plugged into the wall, and the socket is switched on
- Check the green LED on the power supply is lighted
- Check the power supply is plugged into the device
- Check the correct power supply is being used

It doesn't wake up when the Top Slide is moved

The Pulsair Desktop is designed to wake up when the *Top Slide* is moved from left to right, or when the *Start / Stop* button is pressed.

Checks & solutions

- Move the *Top Slide* from left to right
- Press the *Start / Stop* button

The screen picture is red

This can be caused by leaving the red transport dust cover over the front-optic.

Checks & solutions

- Remove the red transport dust cover from the front-optic

It won't move close enough to the patient

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This can be cause by having the patient's eyes too high.

Checks & solutions

- Adjust the high of the patient's eyes as described in the Pulsair Desktop's user guide

It shows faint cross, but won't focus

Checks & solutions

- Check screen controls are adjusted correctly for contrast, colour, and brightness

The picture quality is poor

Checks & solutions

- Check screen controls are adjusted correctly for contrast, colour, and brightness

It won't fire

Checks & solutions

- Check the red LED is on
- Check the *Target Cross* is in focus
- Press and hold the *Clear / Demon* button to simulate a puff.

It clicks, but doesn't fire

Checks & solutions

- Check the *Air Pump* is running
- Check the air pressure from the *Regulator*

It beeps, but doesn't fire

This can be cause by a faulty *Coil / Dump Valve* assembly.

Checks & solutions

- Check / replace the *Coil / Dump Valve* assemblies

It doesn't beep, and readings are within 1mmHg

This can be caused by the beep option being set to *off* in the menu system.

Checks & solutions

- Check / set the beeb option to *on* in the menu system

It's too difficult to fire

Checks & solutions

- Check the *Target Cross* is in focus
- Ask the patient to look directly at the red light
- Clean the front-optic
- Lower light level

It's too easy to fire

Checks & solutions

-

It stops firing after 4 readings

The Pulsair Desktop is designed to stop firing after 4 readings.

Checks & solutions

- Pressing the *Clear / Demon* button will clear the previous readings, and restart the readings process

It shows an error message after firing

An error message can be caused by low air pressure.

Checks & solutions

- Check the air pressure from the *Regulator*

It won't print

The printer paper is thermal – it has a 'right way up'.

Checks & solutions

- Check the printer paper is the 'right way up'

It went quiet, and the screen went blank

The Pulsair Desktop is designed to enter sleep-mode after two minutes.

Checks & solutions

- Press the *Start / Stop* button to wake the device up

It's too noisy

This can be caused by a faulty *Air Pump*.

Checks & solutions

- Check / replace the *Air Pump*

The light is on, but there's no sound

This can be caused by a faulty *Air Pump*.

Checks & solutions

- Check / replace the *Air Pump*

Can’t change the height of the Head Unit

This may be caused by a broken *Drive Belt*.

Checks & solutions

- Check / replace the *Drive Belt*

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Accessing and removing sub-assemblies

Accessing the Base Unit sub-assemblies

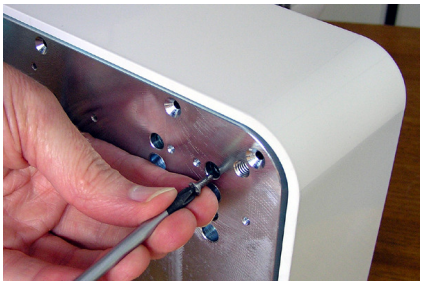
This procedure shows you how to get access to the *Base Unit* sub-assemblies.

Think !

If you're intending to remove the *Air Pump* too – remove its 4 retaining screws (SP13-02216) while you're removing the Base Unit moulding – see Air Pump (page 14)

Air Pump

- Remove the 4 retaining screws holding the *Air Pump* to the *Base Plate*



Removing the Base Unit moulding

The *Base Moulding* (EP19-52784) is secured to the *Base Plate* (EP19-52768) by 11 retaining screws (SP13-02208). The 2 back retaining screws are covered by the 2 back feet (EP39-70364). Each foot is held on the *Base Plate* by 1 retaining screw (SP16-01021), and its head is covered by 1 *Rubber Feet* (EP79-56241).

- Remove the *Printer Door*
- Remove the *Paper Roll*
- Turn the Pulsair Desktop on its right-side
- Remove the *Rubber Feet* from the 2 back feet
- Remove the 2 back feet by removing their retaining screws
- Unscrew the 11 screws securing the *Base Moulding* to the *Base Plate*
- Turn the Pulsair Desktop upright
- Slide the *Base Moulding* backwards off the *Base Plate*

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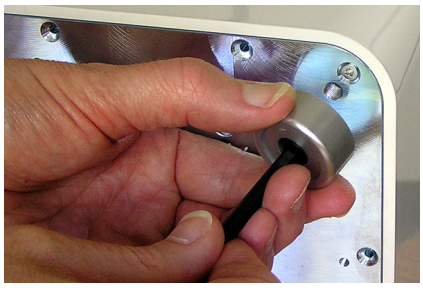


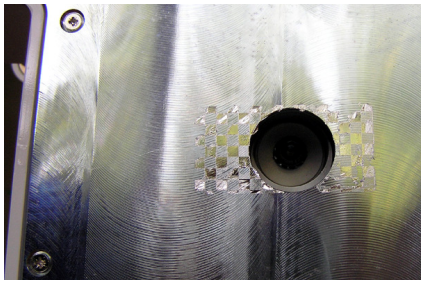
Some sub-assemblies in the *Base Unit* cannot be properly accessed without further disassembly to allow the *Head Unit* to be turned. The *Head Unit* is secured to the *Base Unit* by 1 retaining screw (SP16-01021) through the *XY Bearing Assembly* (2417-P-5009).

The hole through the *Base Plate* giving access to the retaining screw is covered by the 1 *Tamper Proof Label* (EP79-70054), the *Year of Manufacture Label* (EP39-50723), and the *MOD State Label* (EP79-30076).

Loosening the Extrusion Guide Pillar

The *Extrusion Guide Pillar* (EP39-70405) is secured to the *XY Bearing Assembly* (EP29-53842) by the 1 retaining screw (SP16-01021).

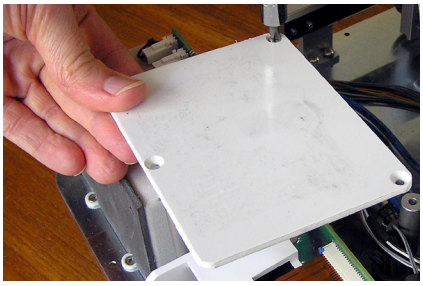
- Turn the Pulsair Desktop on its right-side
- Remove the *Tamper Proof Label* from the *Base Plate*
- Slide the *Head Unit* left to align the head of the screw with the 24mm access hole through the *Base Plate*
- Loosen the retaining screw about 3 complete turns
- Turn the Pulsair Desktop back upright
- Ease the *Head Unit* upward from the *Base Unit*
- Turn the *Head Unit* left, or right (as required) to give access to the *Base Unit* sub-assemblies



Removing the Joystick plate

The *Joystick* plate partially covers some of the sub-assemblies at the back of the *Base Unit*, and removing it may improve your access to the *Base Unit* sub-assemblies. The *Joystick* plate (EP39-70416) is held on the *Joystick Plate Support Pillars* (EP39-70417) by 3 retaining screws (SP13-02216).

- Remove the 3 retaining screws holding the *Joystick* plate
- Remove the *Joystick* plate



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Removing the Base Unit sub-assemblies

Get access to the *Base Unit* sub-assemblies by following Accessing the Base Unit sub-assemblies (page 10), and turning the *Head Unit*.

Unless otherwise stated – reassembly is the reverse of disassembly

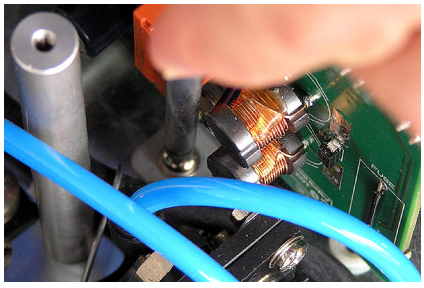
Sound Deadening Box

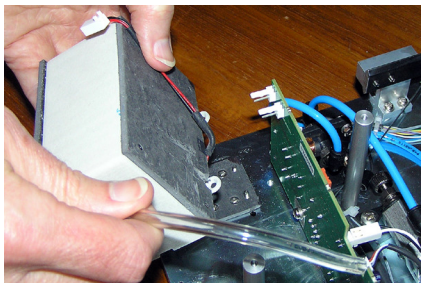
The *Sound Deadening Box* (EP39-70445) is near the back on the left-side. The *Sound Deadening Box* covers the *Air Pump* assembly, and is held on the *Base Plate* by 4 retaining-screws (SP13-02216).

Note:

The *Sound Deadening Box* cannot be removed without partially removing the *Main PCB* first.

- Remove the *Power Switch* loom from the *Main PCB*
- Remove the *Air Pump* loom from the *Main PCB*
- Remove the 4 retaining screws holding the *Printer Bucket* to the *Base Plate*
- Remove the 1 retaining screw holding the *Main PCB* to the *Base Plate*
- Move the *Main PCB* to allow access to the 2 retaining screws at the front of the *Sound Deadening Box*
- Remove the 4 retaining screws holding the *Sound Deadening Box* to the *Base Plate*
- Disconnect the air-line from the *Regulator*
- Lift the *Sound Deadening Box* and *Air Pump* from the *Base Plate*





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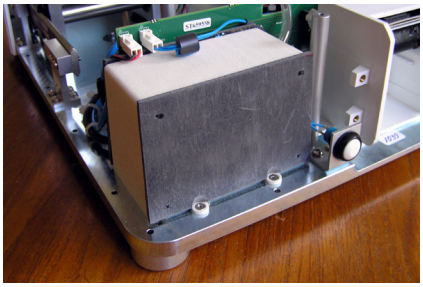
Air Pump

The *Air Pump* assembly is near the back on the left-side. The *Anti-Vibration Mount* (EP39-70444) is held to the *Base Plate* by 4 retaining-screws (SP13-02216). The *Air Pump* assembly is held on the *Base Plate* by 4 retaining-screws (SP13-02216) from the underside of the *Base Plate*.

Think !

If you're removing the *Air Pump* – you should remove its 4 retaining screws (SP13-02216) while you're removing the Base Unit moulding – see Removing the Base Unit moulding (page 10).

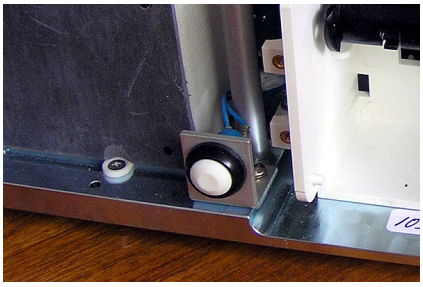
With the 4 retaining screws removed – the *Air Pump* will come off the *Base Plate* when you remove the *Sound Deadening Box* – see Sound Deadening Box (page 13)



Power Switch assembly

The *Power Switch* assembly is at the back near the middle (left-to-right). The *Power Switch* assembly is held on the *Base Plate* by 2 retaining screws (SP13-05011).

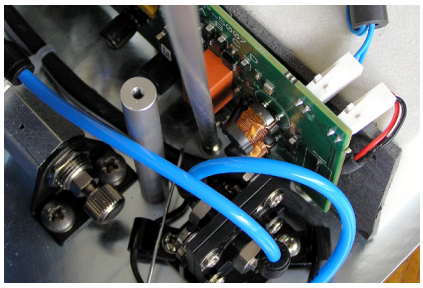
- Disconnect the *Power Switch* loom from the *Main PCB*
- Remove the 2 retaining screws holding the *Power Switch* assembly to the *Base Plate*
- Lift the *Power Switch* assembly from the *Base Plate*

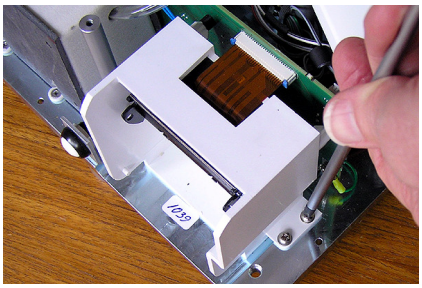


Printer / Main PCB assembly

The *Printer / Main PCB* assembly is near the back – the *Printer* is on the right-side ; the *Main PCB* is in front of that, and runs across the width of the *Base Unit*. The *Printer / Main PCB* assembly is held on the *Base Plate* by 5 retaining screws (SP13-05011).

- Disconnect the *Power Switch* loom
- Disconnect the *Air Pump* power loom
- Disconnect the *12V Coil* power loom
- Disconnect the *Umbilical* power loom
- Disconnect the *Eye Select Switch* loom
- Disconnect the *Easy Pulse Switch* loom
- Disconnect the *Main PCB* power loom
- Disconnect the *USB Interface* loom
- Disconnect the *Dump Valve* loom
- Disconnect the *Air Pump* air-line from the *Regulator*
- Remove the 1 retaining screw holding the *Main PCB* to the *Base Plate*
- Remove the 4 retaining screws holding the *Printer Bucket* to the *Base Plate*
- Lift and slide the *Printer / Main PCB* assembly to the right, and off the *Base Plate*





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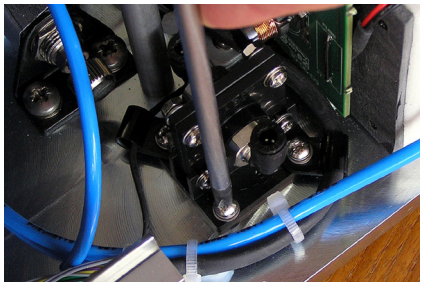
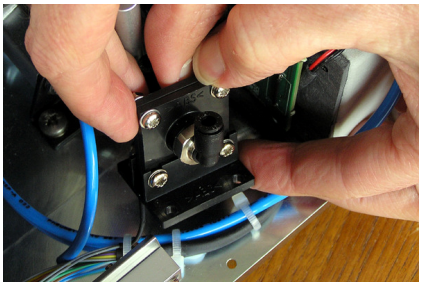
Air Filter

The *Air Filter* assembly is near the back on the left-side. The *Air Filter* assembly is held to the *Base Plate* by 4 retaining-screws (SP13-05011).

- Disconnect both air-lines from the *Air Filter* assembly
- Remove the retaining-screws
- Lift the *Air Filter* assembly from the *Base Plate*

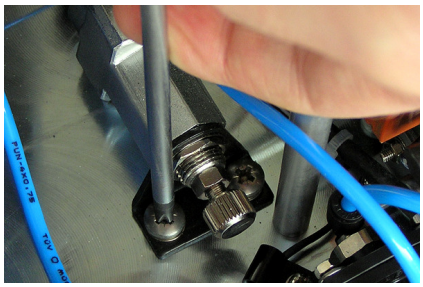


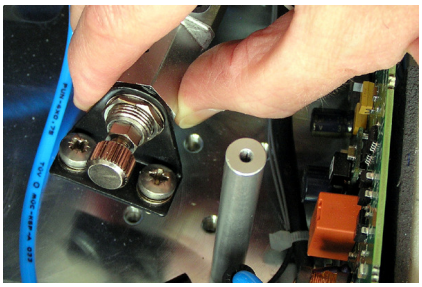


Regulator

The *Regulator* (EP79-70037) is in front of the *Main PCB* near the middle (left-to-right). The *Regulator* is held on the *Base Plate* by 2 retaining screws (SP15-05072).

- Disconnect the 3 air-lines from the *Regulator*
- Remove the 2 retaining screws holding the *Regulator* to the *Base Plate*
- Lift the *Regulator* from the *Base Plate*





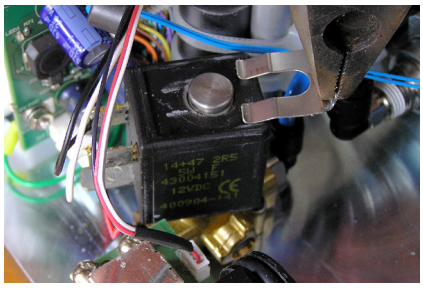
12V Coil

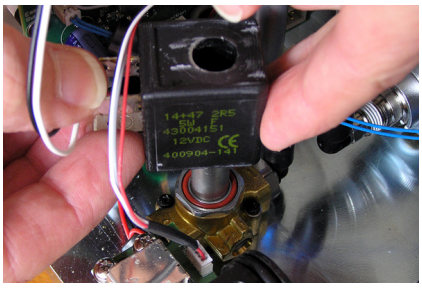
Note:

This procedure assumes you are removing the *12V Coil* – if you are removing the *Dump Valve* too – see the next procedure

The *12V Coil* (EP78-00861) is in front of the *Main PCB* on the right-side, on top of the *Dump Valve*. The *12V Coil* (EP78-00861) is held on the *Dump Valve* by 1 retaining clip.

- Snip the 2 cable-ties holding the *Dump Valve* loom and the *USB Interface* loom together
- Unplug the *Dump Valve* loom from the *Main PCB*
- Remove the retaining clip holding the *12V Coil* on the *Dump Valve*
- Slide the *12V Coil* from the *Dump Valve*

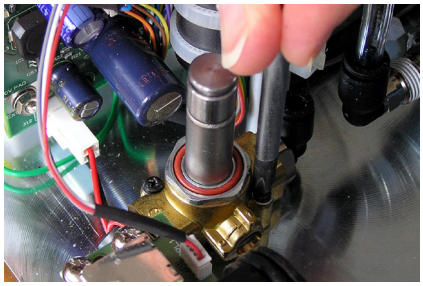


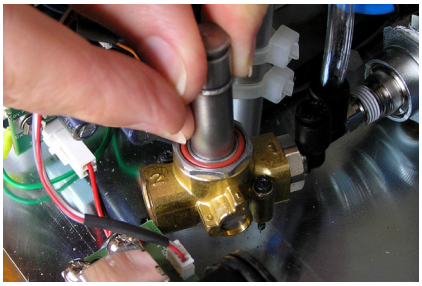


Dump Valve

The *Dump Valve* (EP79-70020) is in front of the *Main PCB* on the right-side. The *Dump Valve* is held on the *Base Plate* by 2 retaining screws (SP12-05109) partially covered by the *12V Coil* (EP78-00861) held on the *Dump Valve* by 1 retaining clip.

- Remove the retaining clip holding the *12V Coil* on the *Dump Valve*
- Lift the *12V Coil* from the *Dump Valve*
- Disconnect the 1 air-line from the *Dump Valve*
- Remove the 2 retaining screws holding the *Dump Valve* to the *Base Plate*
- Lift the *Dump Valve* from the *Base Plate*





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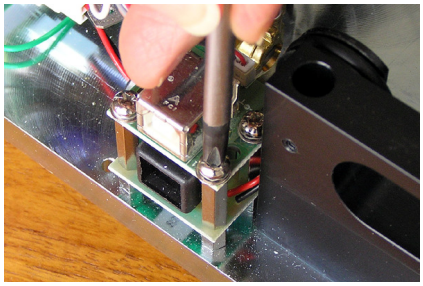
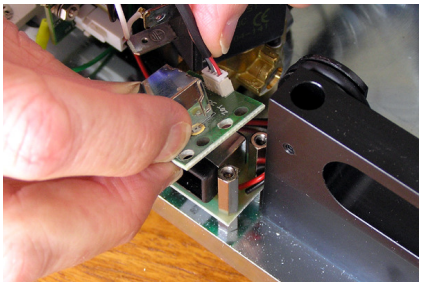
USB PCB

The *USB PCB* (2417-P-5004) is on the right-side, on top of the *Power Socket PCB* (2417-P-5003). The *USB PCB* is held on the 4 (16mm) standoffs (EP79-70056) by 4 retaining screws (SP13-05089).

- Snip the 2 cable-ties holding the *Dump Valve* loom and the *USB Interface* loom together
- Disconnect the *USB PCB* loom from the *Main PCB*
- Remove the 4 retaining screws holding the *USB PCB* on the 4 (16mm) standoffs
- Lift the *USB PCB* from the 4 (16mm) standoffs





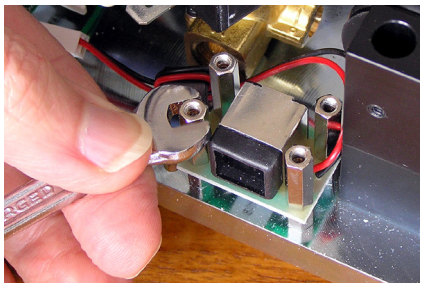
Power Socket PCB

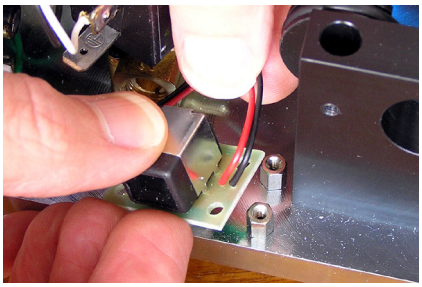
Note:

Removing the *Power Socket PCB* requires removing the *USB PCB* first.

The *Power Socket PCB* (2417-P-5003) is on the right-side, below the *USB PCB* (2417-P-5004). The *Power Socket PCB* is held on the 4 (6mm) standoffs (EP79-56110) by 4 (16mm) standoffs (EP79-70056).

- Disconnect the *Power Socket PCB* power loom
- Remove the 4 (16mm) standoffs
- Lift the *Power Socket PCB* from the 4 (6mm) standoffs





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Accessing the Head Unit sub-assemblies

There are 5 *Head Unit* mouldings – two upper, two lower, and the *Top Slide* moulding, which can usually be left in place.

This procedure shows you how to get access to the *Base Unit* sub-assemblies.

Removing the upper-right Head Unit moulding

The upper-right *Head Unit* moulding (EP19-52813) is held on the *Head Unit* by 2 retaining screws (SP13-05249) through the upper-left *Head Unit* moulding (EP19-52805), and an interlocking clip at the back of the mouldings.

- Remove the 2 retaining screws from the upper-left *Head Unit* moulding
- Ease the upper-right *Head Unit* moulding from the *Head Unit*

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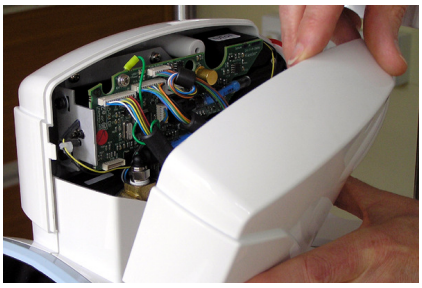
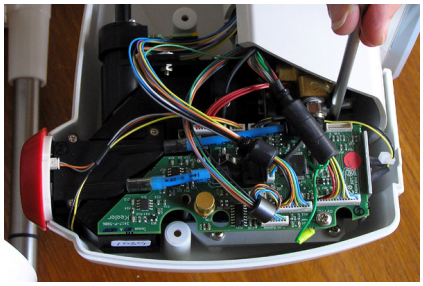
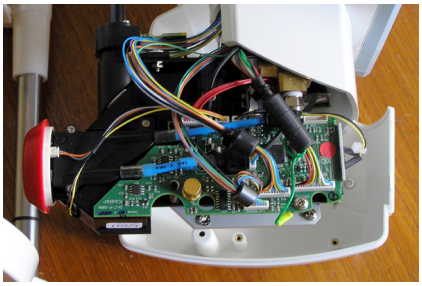


Removing the upper-left Head Unit moulding

The upper-left *Head Unit* moulding (EP19-52805) is held on the *Head Unit* by 3 retaining screws (SP13-05011) through the *Mainframe Mount* plate (EP39-70428).

- Turn the Pulsair Desktop on its right-side
- Remove the 3 retaining screws from the *Mainframe Mount* plate
- Carefully allow the upper-left *Head Unit* moulding to drop from the *Head Unit*
- Turn the Pulsair Desktop upright





Screen Assembly

Think !

Neither the lower-right *Head Unit* moulding (EP19-52848), nor the lower-left *Head Unit* moulding (EP19-52848) can be removed without removing the *Screen Assembly* first

The *Screen Assembly* is held on the *Head Unit* by 2 nylon retaining screws (SP13-05257) through the lower-right *Head Unit* moulding, and 2 nylon retaining screws (SP13-05257) through the lower-left *Head Unit* moulding.

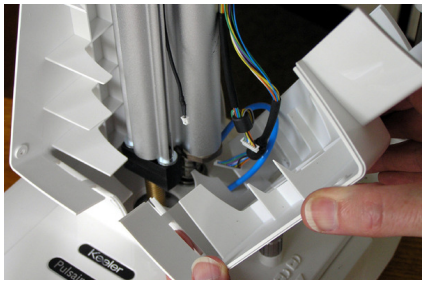
- Remove the 2 nylon retaining screws through the lower-right *Head Unit* moulding
- Remove the 2 nylon retaining screws through the lower-left *Head Unit* moulding
- Carefully ease the *Screen Assembly* from the *Head Unit*
- Disconnect *Control Button* loom from *Display PCB*

- Disconnect *Numeric Display* loom from *Display PCB*
- Disconnect *Video* loom from *Display PCB*

Removing the lower-right Head Unit moulding

The lower-right *Head Unit* moulding (EP19-52848) is held to the *Top Slide* assembly by 2 retaining screws (SP13-05230).

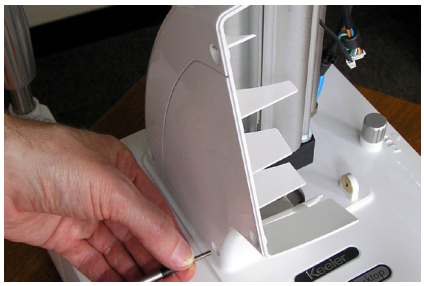
- Remove the 2 retaining screws holding the lower-right *Head Unit* moulding to the *Top Slide*
- Ease the lower-right *Head Unit* moulding from the *Head Unit*

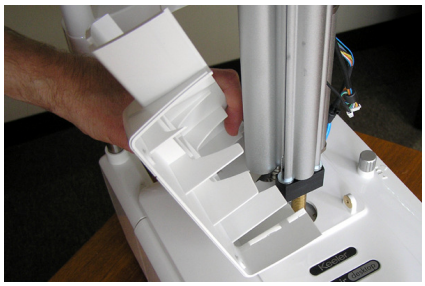


Removing the lower-left Head Unit moulding

The lower-left *Head Unit* moulding (EP19-52821) is held to the *Top Slide* assembly by 2 retaining screws (SP13-05230).

- Remove the 2 retaining screws holding the lower-left *Head Unit* moulding to the *Top Slide*
- Ease the lower-left *Head Unit* moulding from the *Head Unit*





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Removing the Head Unit sub-assemblies

Get access to the *Head Unit* sub-assemblies by following Accessing the Head Unit sub-assemblies (page 19).

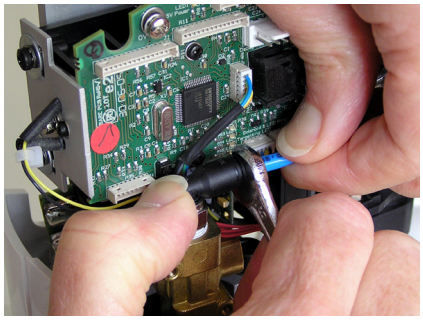
Unless otherwise stated – reassembly is the reverse of disassembly

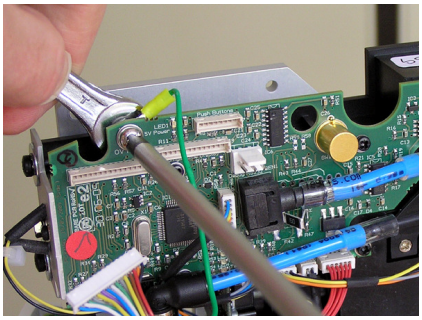
Mainframe

The *Mainframe* (EP19-70013) is held to the *Mainframe Mount* plate by 4 retaining screws (SP13-05206) through the *Mainframe Mount* plate (EP39-70428).

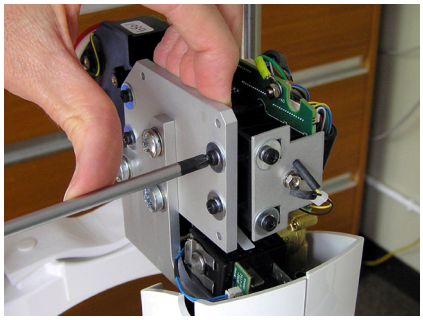
The *Mainframe* (EP19-70013) is also 'plumbed in' to the *Head Unit* by 4 looms, an air-line, and an earth.

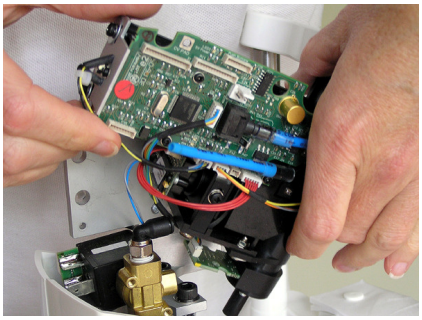
- Disconnect the air-line from the valve
- Disconnect the earth connection





- Disconnect the *Push Buttons* loom
- Disconnect the *Single Line Display* loom
- Disconnect the *Umbilical Connection* loom
- Disconnect the *Camera Out* loom
- Disconnect the *6V Coil* loom
- Remove the 4 retaining screws from the *Mainframe Mount* plate
- Ease the *Mainframe* from the *Head Unit*





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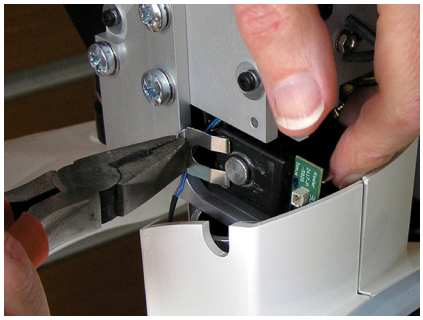
6V Coil

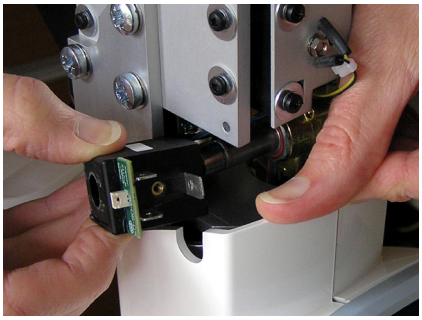
Note:

This procedure assumes you are removing the *6V Coil* – if you are removing the *Dump Valve* too – see the next procedure

The *6V Coil* (EP79-70019) is at the back of the *Head Unit*. The *6V Coil* is held on the *Dump Valve* by 1 retaining clip.

- Raise the *Head Unit* to its maximum height
- Disconnect the *6V Coil* loom
- Remove the retaining clip holding the *6V Coil* on the *Dump Valve*
- Slide the *6V Coil* from the *Dump Valve*





Dump Valve

Think !

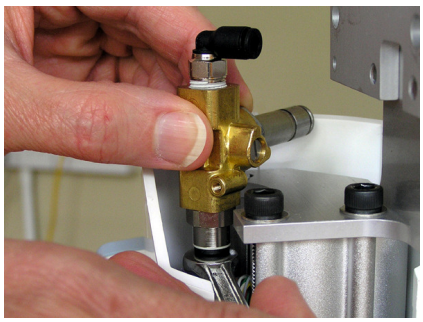
The *Dump Valve* can be removed with the *Mainframe* in place – removing the *6V Coil,* and *Mainframe* first reduces the risk of the *Mainframe* getting damaged in the process

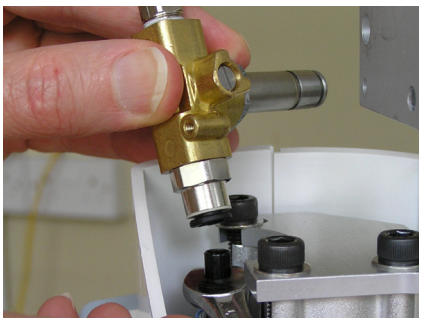
Note:

The *Dump Valve* can only be removed if the upper *Head Unit* mouldings are off, **and** either the *Mainframe* **or** the lower *Head Unit* mouldings are removed too

The *Dump Valve* (EP79-70020) is held on the *Reservoir* fitting by a quick-release fitting. With the upper *Head Unit* mouldings off – access to the *Dump Valve* is further restricted by the *Mainframe,* and the lower *Head Unit* mouldings.

- Raise the *Head Unit* to its maximum height
- Release the *Dump Valve* from the *Reservoir* fitting
- Ease the *Dump Valve* from the *Head Unit*





Joystick

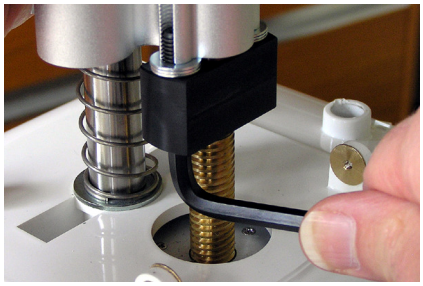
The *Joystick* is held on the *Joystick* pulley by an internal thread, and 1 locking grub-screw (SP14-00001). The locking grub-screw is covered by the *Joystick* sleeve (EP39-70369).

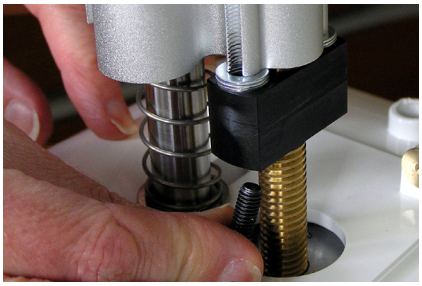
- Slide the *Joystick* sleeve from the *Joystick*
- Back-off the 1 locking grub-screw through the *Joystick*
- Unscrew the *Joystick* from the *Joystick* pulley

Reservoir Extrusion

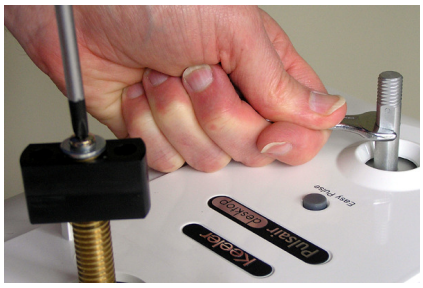
The *Reservoir Extrusion* (EP29-53834) is held on the *Drive Pillar* (EP39-70374) by the *Drive Pillar Bush* (EP39-70426). The *Drive Pillar Bush* is held on the *Reservoir Extrusion* by 2 retaining screws (SP16-01021).). The *Drive Pillar Bush* is 'stopped' on the *Drive Pillar* by 1 retaining screw (SP14-05071).

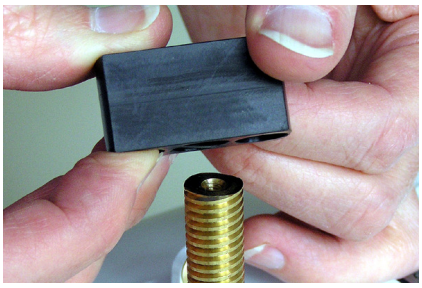
- Remove the 2 retaining screws





- Lift the *Reservoir Extrusion* from the *Top Slide*
- Remove the 'stop' retaining screw
- Remove the *Drive Pillar Bush* from the *Drive Pillar*

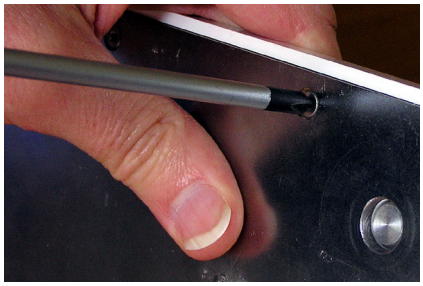




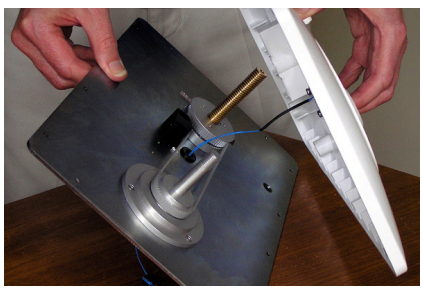
Drive Belt

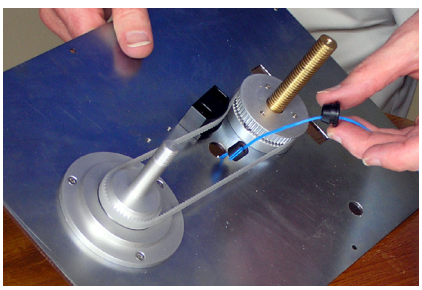
The *Drive Belt* (EP79-56217) is inside the *Top Slide* assembly, and wraps around the *Head Unit* pulley (EP39-70373), and the *Joystick* pulley (EP39-70366). The tension in the *Drive Belt* is set with the *Drive Belt Tensioner* (EP39-70407). The *Top Slide* moulding (EP19-52792) is held on the *Top Slide* plate (EP29-53797) by 12 retaining screws (SP13-02216).

- Separate the *Head Unit* from the *Base Unit* – see Separating the Head Unit from the Base Unit (page 28)
- Remove the *Joystick* from the *Top Slide* assembly – see Joystick (page 25)
- Remove the *Reservoir Extrusion* from the *Top Slide* assembly – see Reservoir Extrusion (page 25)
- Remove the 12 retaining screws holding the *Top Slide* moulding on the *Top Slide* plate



- Lift the *Top Slide* moulding from the *Top Slide* plate
- Push the grommet through the *Top Slide* plate with the *Easy Pulse Switch* loom





- Loosen the 2 retaining screws holding the *Drive Belt Tensioner*

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- Slide the *Drive Belt Tensioner* towards the left
- Lift the *Drive Belt* from around the *Head Unit* pulley, and the *Joystick* pulley

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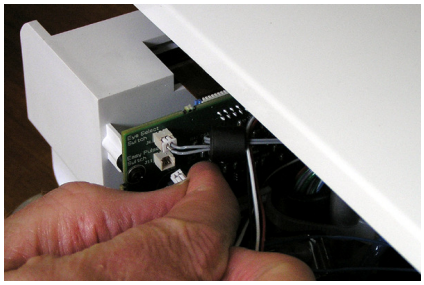
Separating the Head Unit from the Base Unit

Note:

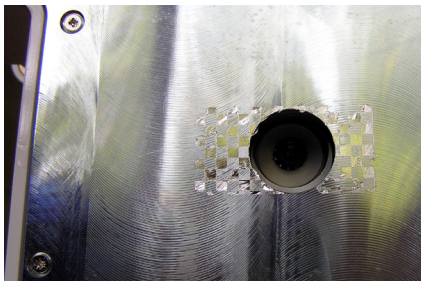
This procedure assumes you need to access the inside of the *Top Slide* assembly – or are replacing the *Head Unit* completely

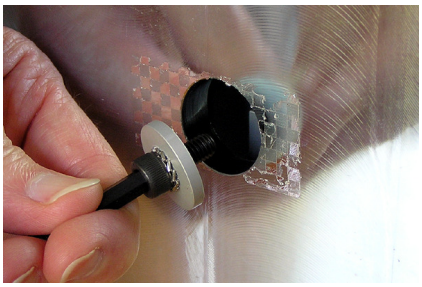
The *Head Unit* is secured to the *Base Unit* by 1 retaining screw (SP16-01021) that holds the *Extrusion Guide Pillar* (EP39-70405) to the *XY Bearing Assembly* (2417-P-5009).

- Remove the *Base Unit Moulding* – see Removing the Base Unit moulding (page 10)
- Disconnect the *Easy Pulse Switch* loom from the *Main PCB*



- Turn the Pulsair Desktop on its right-side
- Remove the *Tamper Proof Label* from the *Base Plate*
- Slide the *Head Unit* left to align the head of the screw with the 24mm access hole through the *Base Plate*
- Remove the retaining screw, and its washer





Think !

The *Head Unit* and the *Base Unit* are no longer physically held together !

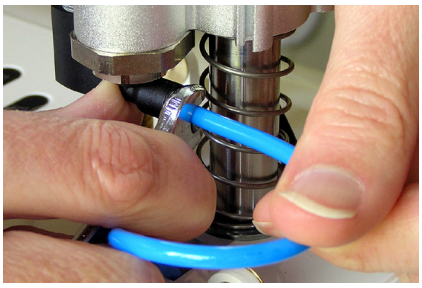
- **Carefully** – turn the Pulsair Desktop upright

Remove Head Unit mouldings

- Remove the upper-right *Head Unit* moulding – see Removing the upper-right Head Unit moulding (page 19)
- Remove the upper-left *Head Unit* moulding – see Removing the upper-left Head Unit moulding (page 20)
- Remove the *Screen Assembly* – see Screen Assembly (page 10)
- Remove the lower-right *Head Unit* moulding – see Accessing the Base Unit sub-assemblies (page 21)
- Remove the lower-left *Head Unit* moulding – see Accessing the Base Unit sub-assemblies (page 21)

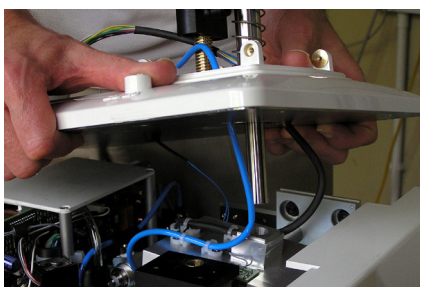
Remove Head Unit sub-assemblies

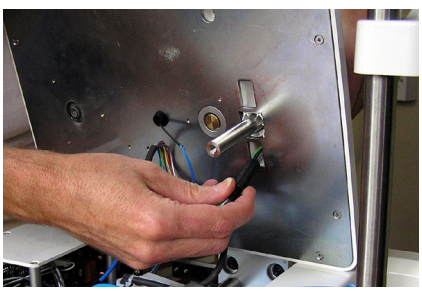
- Remove the *Mainframe* – see Mainframe (page 23)
- Remove the *6V Coil* – see 6V Coil (page 24)
- Remove the *Dump Valve* – see Dump Valve (page 24)
- Feed the *Umbilical* through the *Reservoir Extrusion*
- Disconnect the air-line from the *Reservoir*



Ease Head Unit from Base Unit

- Ease the *Head Unit* upward from the *Base Unit*
- Feed the air-line through the *Top Slide*
- Feed the *Umbilical* through the *Top Slide*





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Appendix A – Detailed Guide to Calibration

Notes:

Ensure that Main PCB is programmed before starting this calibration procedure.

Ensure that unit to be calibrated is placed in alignment plate TD786 and screwed securely with 4 off screws/washers.

This calibration procedure is to be carried out only in the calibrated calibration box as this affects the accuracy of the procedure itself.

Op. No. 10

Place the unit to be calibrated in the calibration jig (e.g. S/N1513), refer to set up as shown in Figure 1. Connect 4 off cables from the jig as marked 1, 2, 3, and 4 in Figure 1 to their corresponding connectors in the PCB.

Ps. do not forget to connect the GREEN cable with a crocodile end termination to the PCB plated screw hole. [Type a quote from the document or the summary of an interesting point. You can position the text box anywhere in the document. Use the Text Box Tools tab to change the formatting of the pull quote text box.]

Connect reservoir to solenoid as shown in Figure 1. Loosen 2 off photodiode holding screws of photodiode assembly to allow room for photodiode adjustment.

Locate and position photodiode mount Cover protruding end into the groove of photodiode holder on the jig. Use adjusting knobs of calibration jig if required and secure photodiode with the lever clamp.

Op. No. 20

Switch on the calibration system and start the pump running.

Ensure that display screen of the Pulsair Desktop is functioning.

Run the Tonometer calibration software. The following screen appears on computer monitor momentarily, as shown in Figure 2. This is immediately followed by the window shown in Figure 3

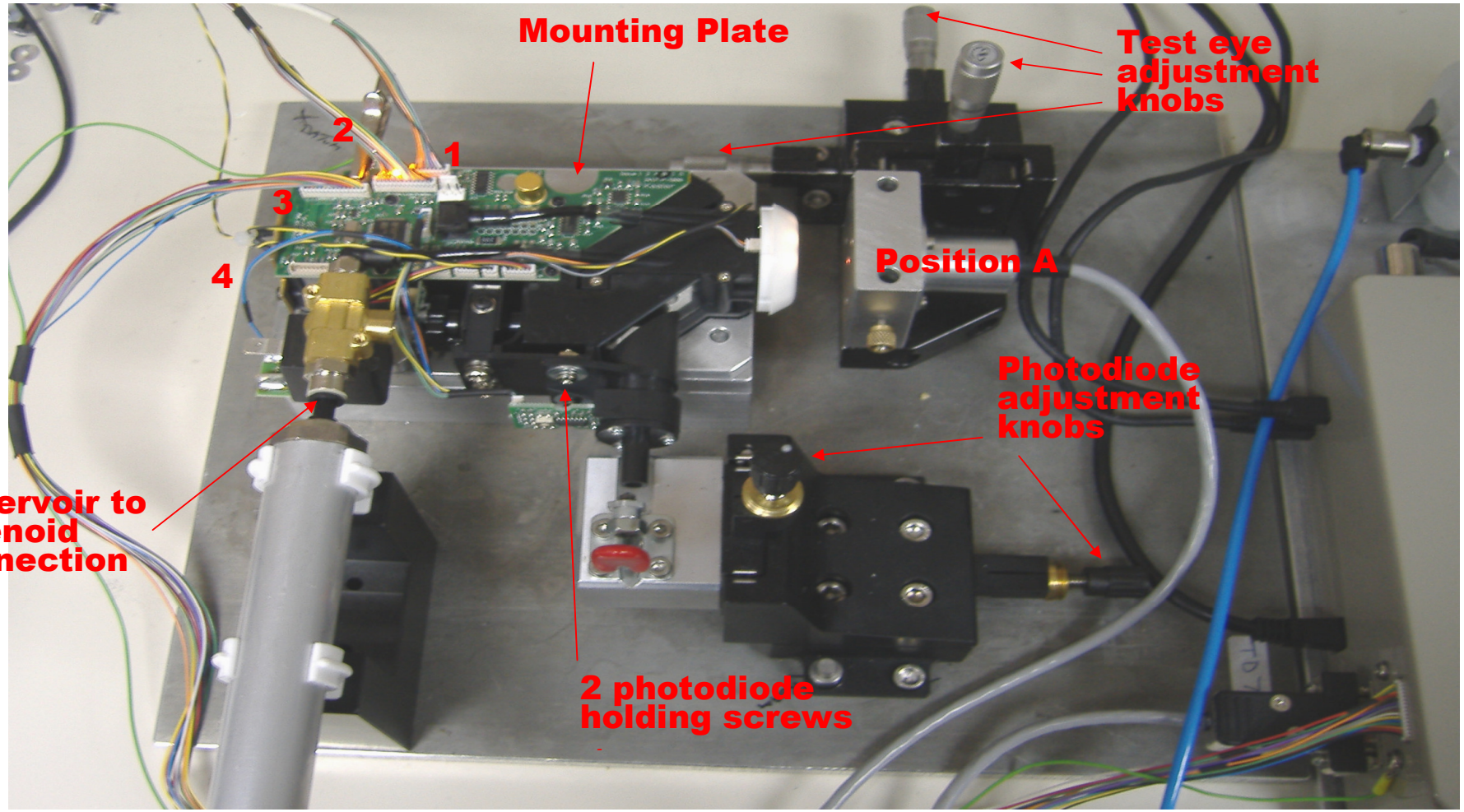

Figure 1: Set up for Calibration

Figure 2: Flash screen appearing on screen after calibration software is started.

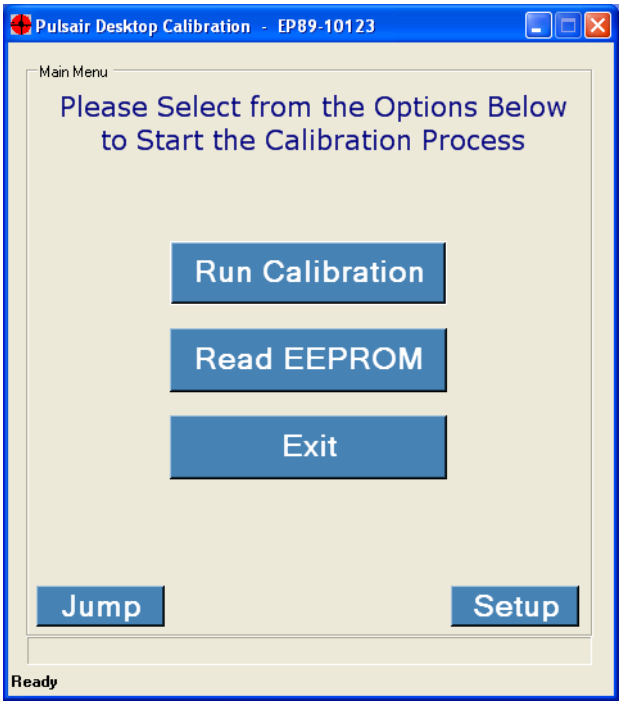

Figure 3: Screen shot with options to proceed with calibration

Op. No. 30

Press the Run Calibration button to start the calibration process. At this stage, the PC tries to establish communication with the system under calibration as shown by the progress bar in the form below.

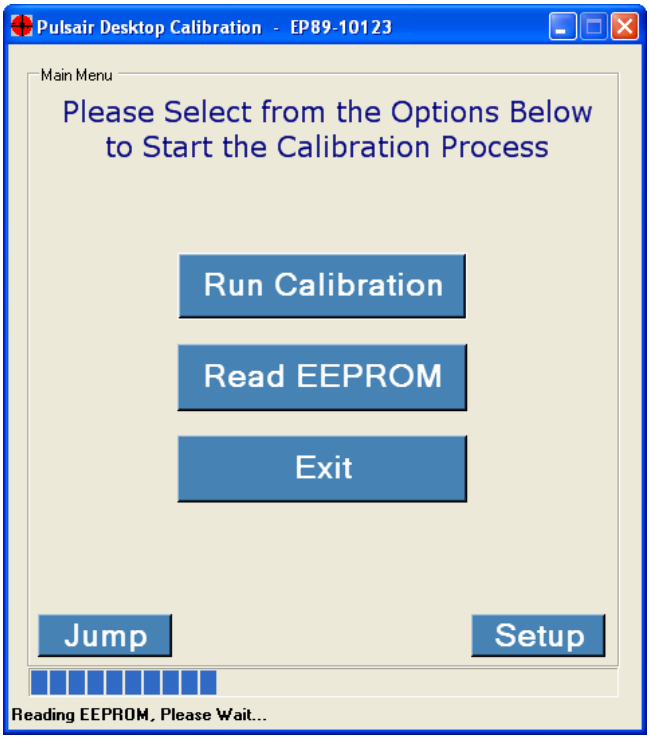

Figure 4: Screen shot with options to proceed with calibration

Note: *If connection is not established with the host PC or calibration unit, the dialog shown below (as in Figure 5) is displayed. Press OK to dismiss the dialog and check the unit under calibration is powered on and all the communication leads are connected. Switch OFF the Pulsair and Switch it back ON and run Tonometer Calibration software again to proceed with calibration.*

If this fails, reset the PC, switch OFF the Pulsair and the calibration box and then switch them back ON and try again until uninterrupted communication is established.

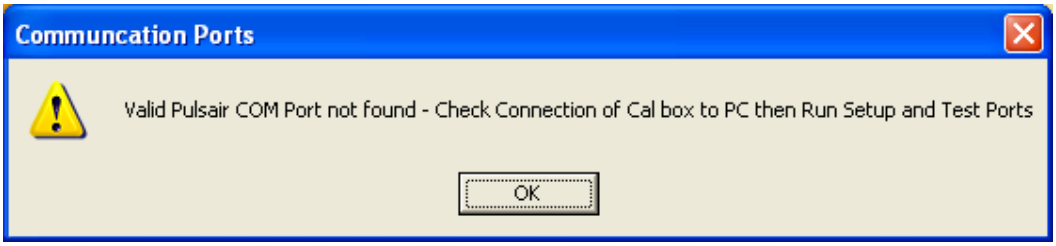

Figure 5: Message to indicate communication failure.

Note: Pressing the setup button loads the Setup form where available COM ports can be checked. The other fields in this form are read only and the data displayed is calibration parameters as saved in the windows registry. The Jump button allows the user to skip the calibration process and takes the user to the event setting process, this option should only be used with a calibrated system where there is a requirement to change the event point setting using the rubber eye. In most cases these two options are hardly used.

Op. No. 40

If the unit was not previously calibrated at any stage, Computer screen prompts the forms as shown in Figure 6. Click OK in the first form and it will automatically lead to the second form of Figure 6. Then Computer screen will prompt the Data entry form as shown in Figure 7.

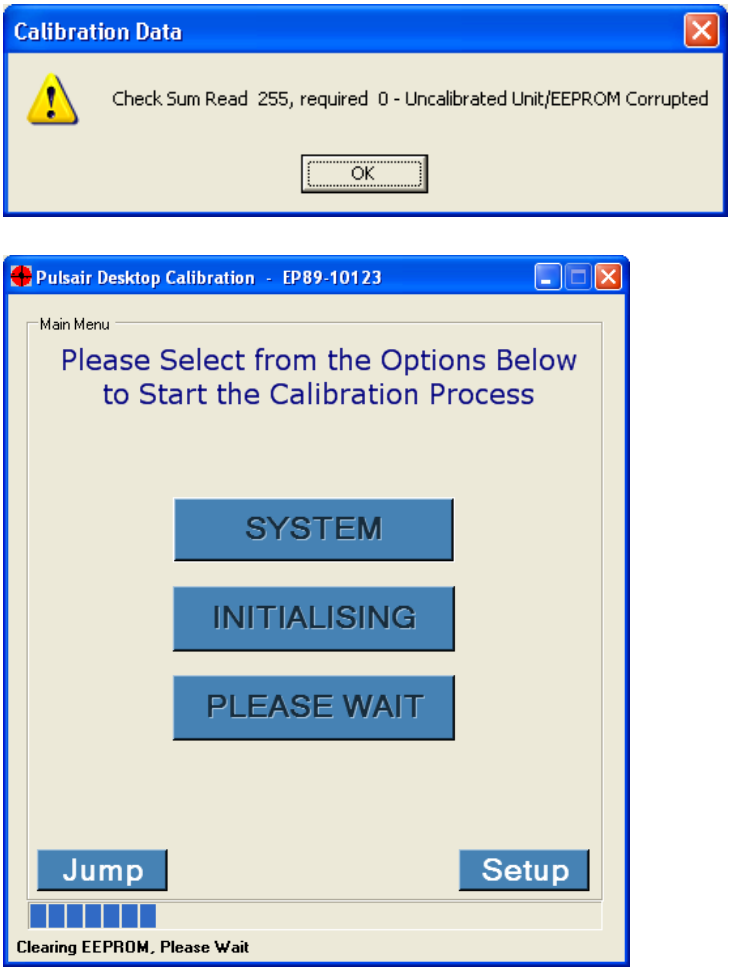

Figure 6: Computer prompt to indicate unit has not been previously calibrated.

However, if the unit was previously calibrated, the process proceeds to data entry form of Figure 7 without displaying the forms of Figure 6.

Op. No. 50

Enter following data in various fields of Data Entry Form, as shown in Figure 7:

Operator Initials (For Example: DG for Dave Graham)

Unit Serial Number (For Example: 2417/1000)

Mode State Label (For example 5, but confirm this with Line manager before entering this as Mode State could have been updated).

Calibration Jig S/N (For example: 1513)

When the required details are entered the user is allowed to continue. The date is set automatically to the current date. All these data is retained in the EEPROM of the unit under calibration until it is changed on another calibration.

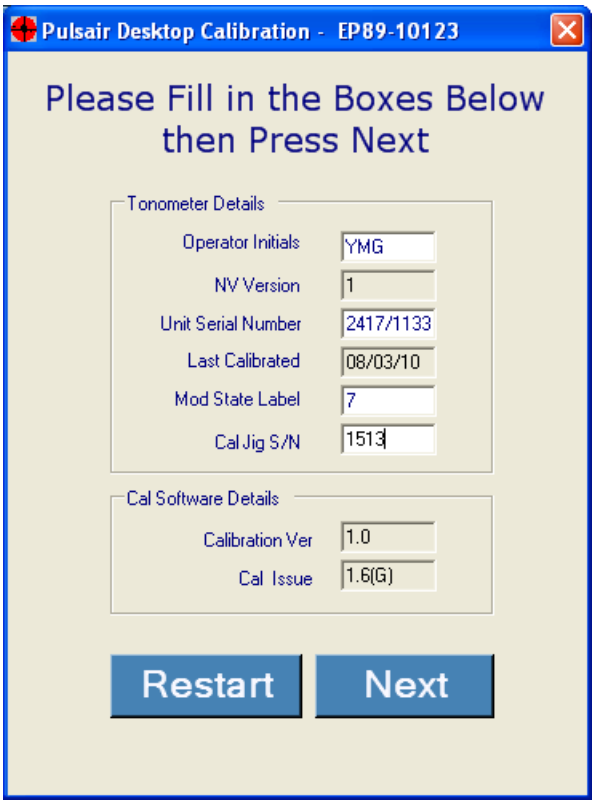

Figure 7: Data Entry Form

Op. No. 60

Select the Next button in Data Entry form and the calibration program prompts the user to mount the test eye in position as shown in the form below (Figure 8).

At this stage, if any of the data fields are not entered, the user is prompted to enter the required data before progressing to the next stage of the calibration process.

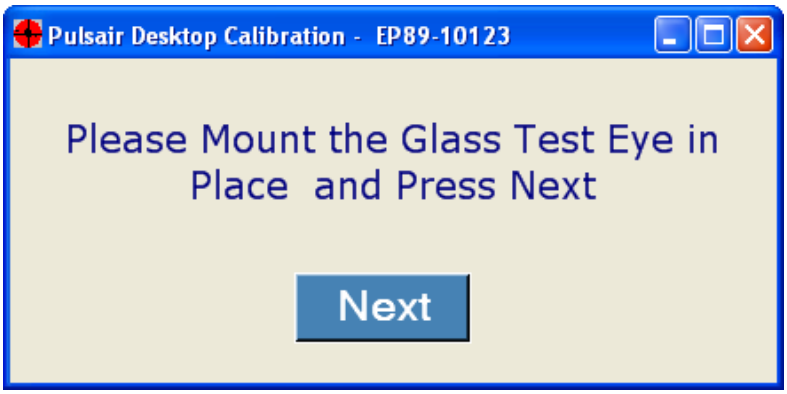

Figure 8: Form to indicate glass test eye to be mounted in position.

Op. No. 70

Mount the test eye in position A as marked in Figure 1, securing it properly in its place and aligning (using test eye alignment knobs (3 off) in the jig) until the target cross is in focus as shown in Figure 9 below and Press the Next button in Figure 8. This will display the alignment form shown in Figure 10.

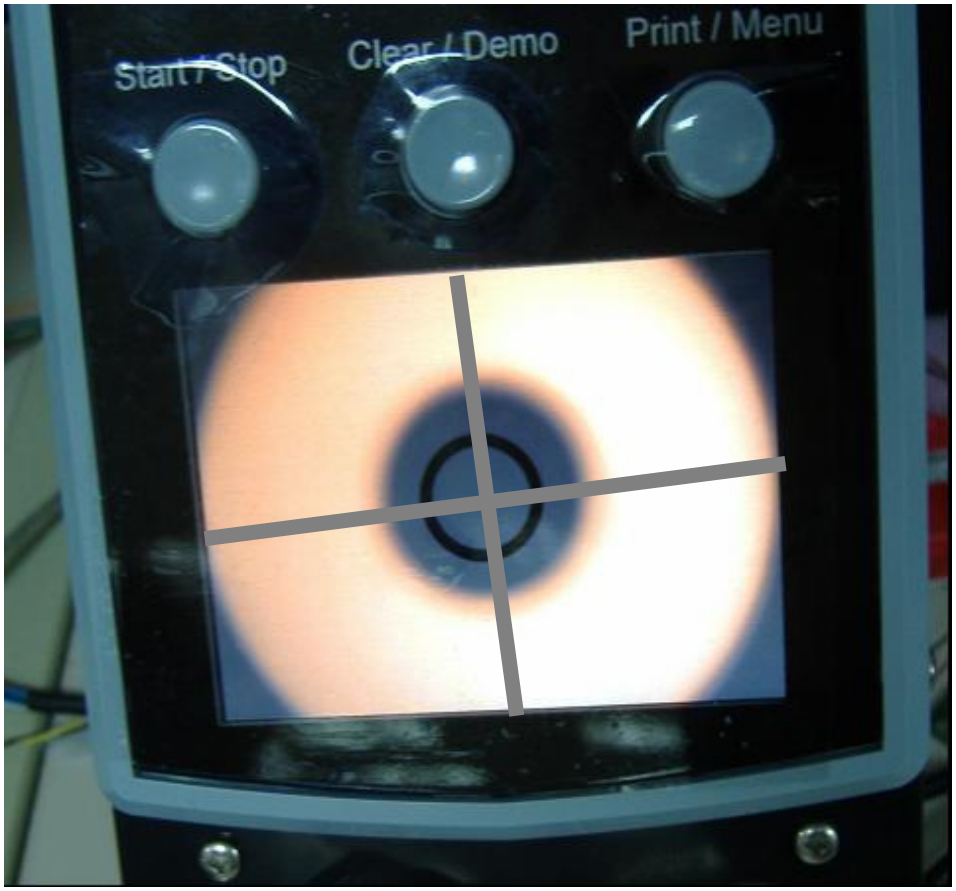

Figure 9: Showing glass test eye in position.

Op. No. 80

Press the Start button on the Alignment Form and the ADC values of the detected light at the three photo detectors A, B and C as well as the K value is displayed. This form allows light level adjustment in order to set the light intensity to meet a predefined firing condition.

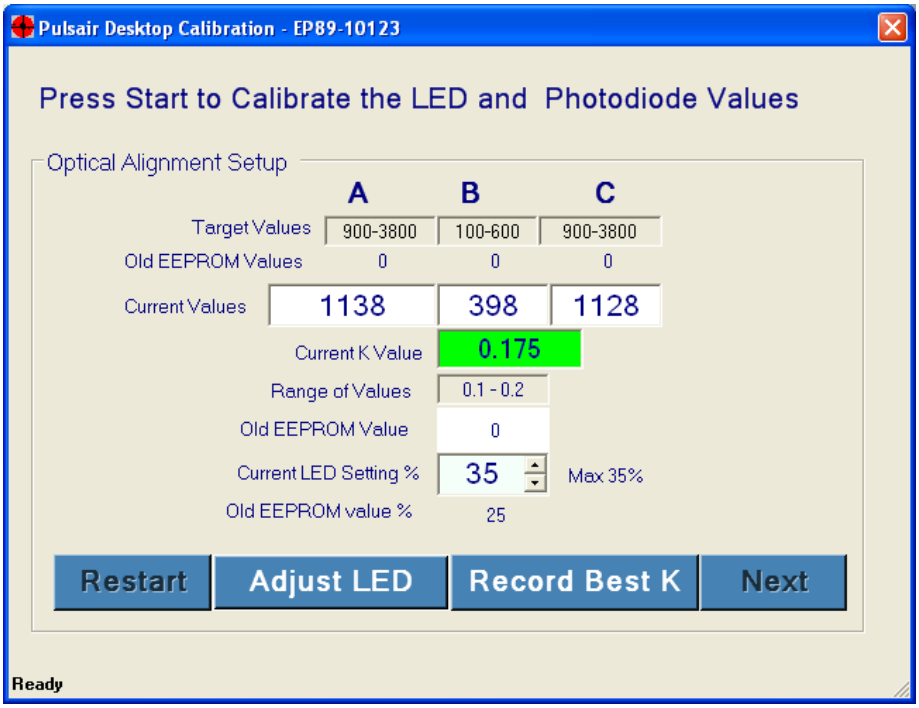

Figure 10: Alignment Form showing photodiode and K values

Op. No. 90

Follow the steps below for best alignment with the glass test eye in position and the target cross is in focus and central as viewed on the LCD screen.

Loosen (if not lose already) the two screws holding the photodiode & Contrast lens assembly from the main frame so that the micrometer adjustment on the jig can be used to position this assembly relative to the main frame.

Ensure the photodiode end cap is clamped with the lever of the toggle clamp.

Turn the pot on the photodiode PCB fully anticlockwise.

Adjust the micrometer on the photodiode clamp until Best K is achieved.

At this stage, the LED holder can be adjusted to achieve an even illumination of the test eye as viewed on the LCD screen while achieving best K and a reasonable balance between photodiode A & C signal levels.

Adjust the LED brightness if necessary in achieving the best K by setting the % to the desired level and pressing the Adjust LED button. *NB. If the system goes to sleep in this process, the LED setting is*

not retained at this stage of the calibration process and thus must be set again after the instrument is restarted by pressing the Start/Stop button on the console.

If after aligning the photodiode assembly the best K achieved is still in the Red while A & C are within the indicated range, then turn the pot clockwise until K is between 0.17 to 0.18 or B is with in the range indicated – whichever is achieved first.

When Best K is achieved, the K factor display will be lime green and the Record Best K button enabled otherwise the display will be red and the Record Best K button disabled to force the user to align the system against the test eye for best K position before progressing with the remaining calibration process. Once best K is achieved, the photodiode and contrast lens assembly can be screwed tight to the main frame while the lever of the toggle clamp is in position.

Finally use VANISTOP LOCTITE to pot-lock the potentiometer.

Trouble shooting: to achieve best K, A, B & C values must fall within the range indicated as target values in Figure 10. If the target values cannot be achieved because they fall below the lower threshold indicated even after the LED setting % is set to maximum, then change the LED block. If on the other hand, the ABC readings are above the indicated upper threshold, decrease the LED setting until they fall within the range. Again as in all the forms in the program, Restart button is available to send the program to its previous stage.

NB. If the system goes to sleep at this stage of the process, press the Start/Stop button on the display console to wake up the system and the program should resume automatically without needing to run it again.

Op. No. 100

Once Best K is achieved, Press the Record Best K button and the dialogue shown in Figure 11 below will be shown. At this stage remove the test eye and press Next to continue.

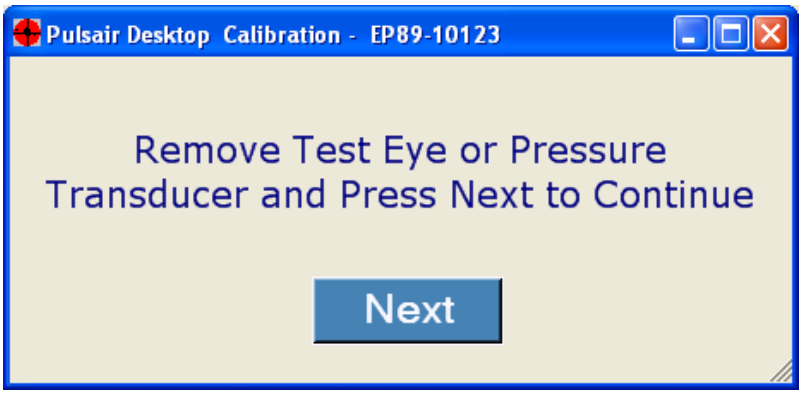

Figure 11: Remove Test Eye dialogue

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Op. No. 110

Once the test eye is removed, press NEXT in the form shown in Figure 12 to continue.

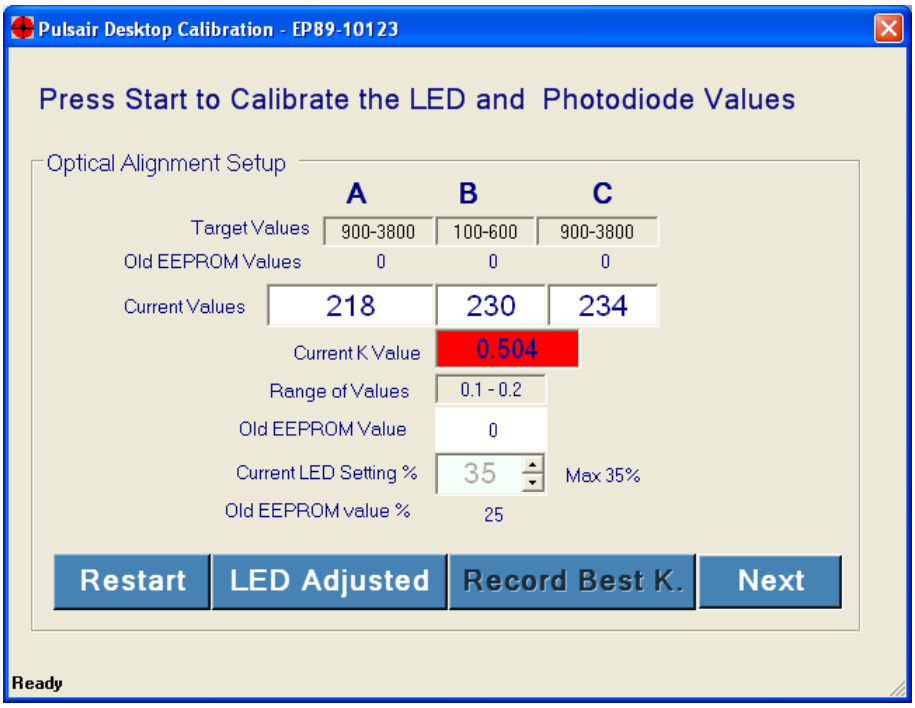


Figure 12: Dark values

Note: *If the Next button on the alignment form (Figure 12) is pressed before the test eye is removed from position, the following message is displayed informing the user to remove the test eye before dark current values are recorded. Remove the test eye and press OK to dismiss this dialogue.*

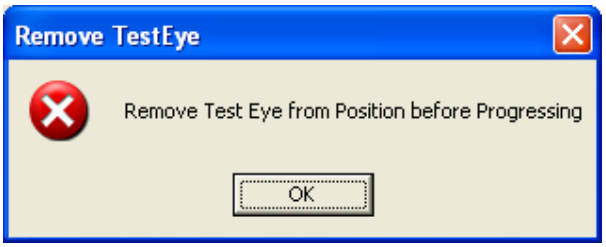


Figure 13: Dialogue to remove test eye

Op. No. 120

Pressing Next button in Figure 13 above, displays the dialogue shown in Figure 14 below instructing the operator to replace the test eye with the external pressure transducer. Press Next button to continue.

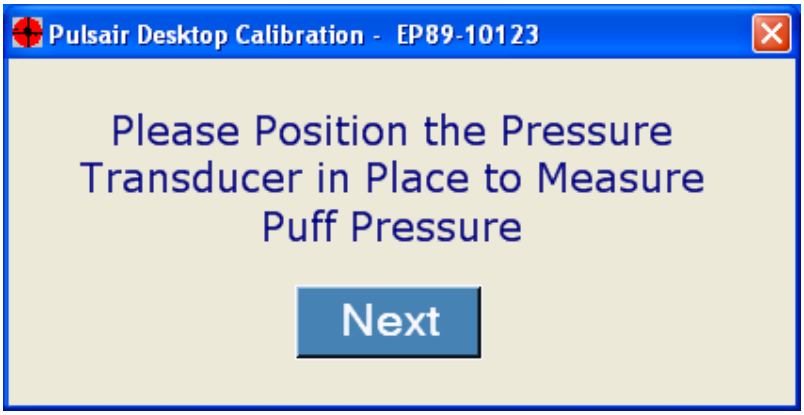

Pulsair Desktop Calibration - EP89-10123
Please Position the Pressure Transducer in Place to Measure Puff Pressure
Next

Figure 14: Pressure Transducer dialogue

Op. No. 130

Secure the pressure transducer on the alignment jig and Press Start button in Figure 15. At this stage the unit under calibration will start to puff air. This puffing process will continue while the button labelled Next in Figure 15 is greyed out, once this process is complete, the Next button becomes active.

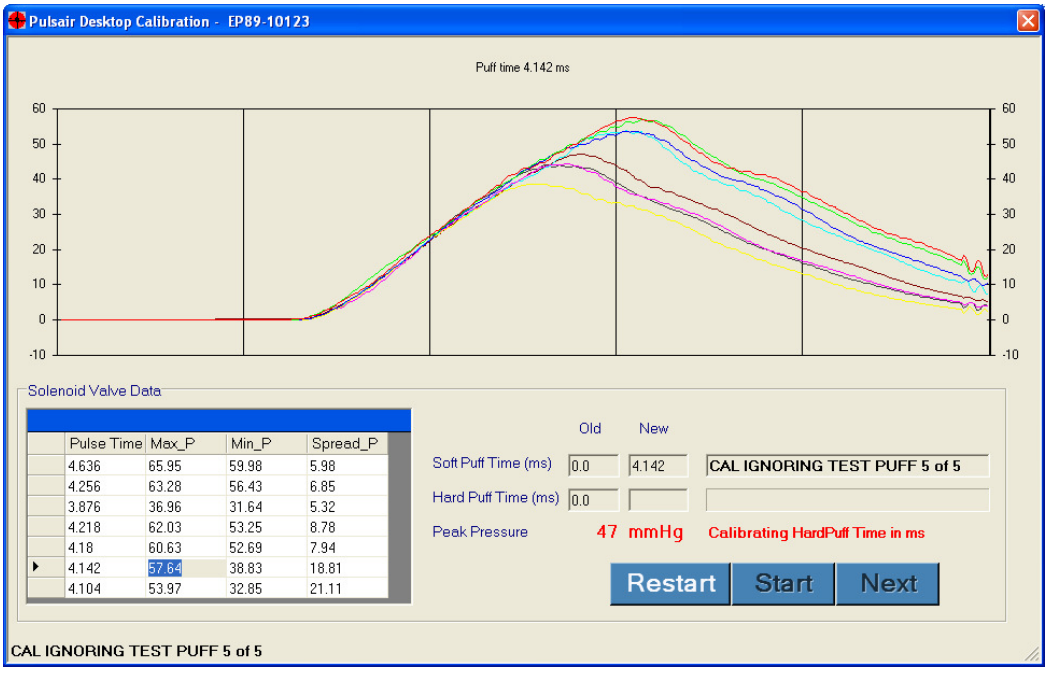


Figure 15: Solenoid valve calibration

Note: *During this process if the measured puff pressure is below a minimum threshold, the program displays the message shown in the dialogue below to advice the user to check the reservoir pressure before rejecting the valve. This will terminate the calibration process after pressing OK.*

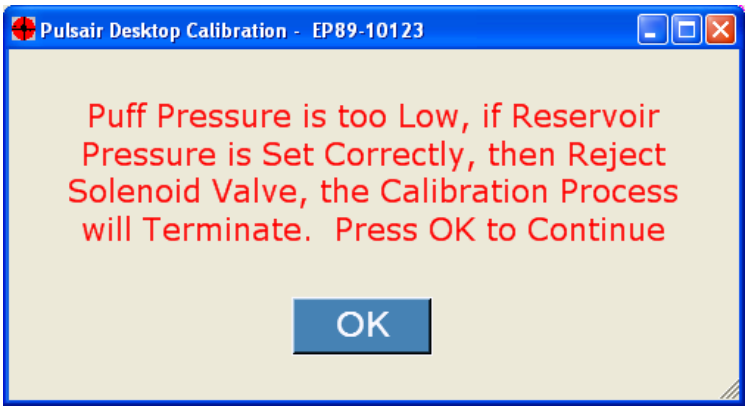

Pulsair Desktop Calibration - EP89-10123
Puff Pressure is too Low, if Reservoir Pressure is Set Correctly, then Reject Solenoid Valve, the Calibration Process will Terminate. Press OK to Continue
OK

Figure 16: Reject solenoid valve dialogue

Op. No. 140

Once the solenoid is calibrated successfully, the user is then prompted with the dialogue box shown in Figure 17 below.

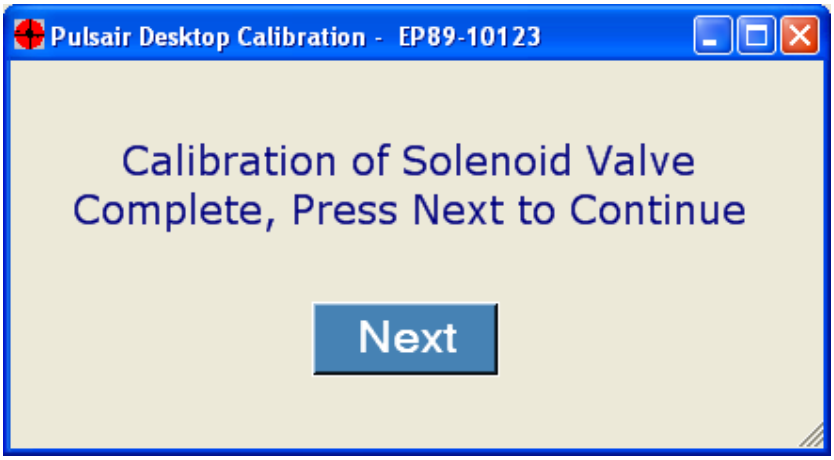


Figure 17: Solenoid valve calibration complete dialogue

On selection of the Next button, the calibration process will continue to the next stage.

Op. No. 150

Without removing the pressure transducer, press Start button on Figure 18, and the unit under calibration will start puffing 20 times before this process is complete. Once this process is complete, the button labelled as Next becomes active.

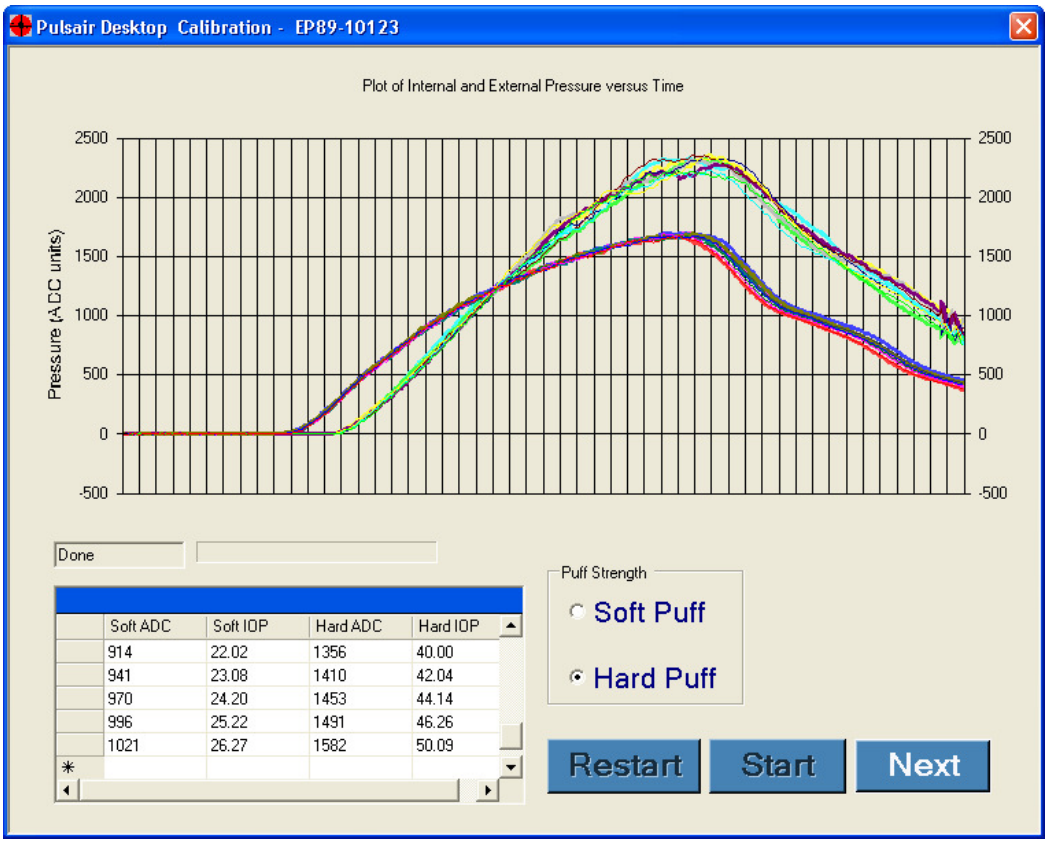


Figure 18: Pressure calibration form

Notes: *During this process if the measured internal puff pressure is below a minimum threshold, the program displays the message shown in the dialogue below to advice the user to check the internal pressure transducer pipes for any air leak before rejecting the PCB. This will terminate the calibration process after pressing OK. In some cases, this could be due to the solenoid valve being marginal, so it may be cured by replacing the solenoid valve.*

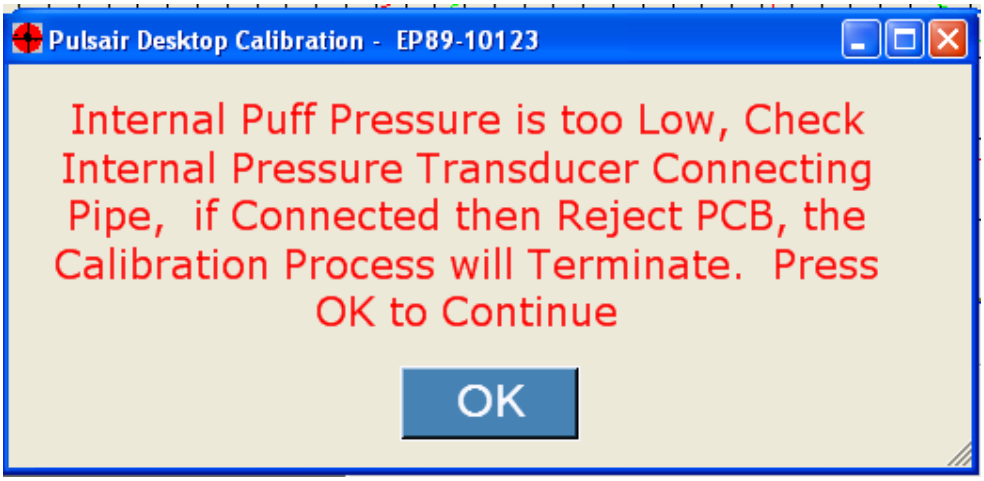

Pulsair Desktop Calibration - EP89-10123
Internal Puff Pressure is too Low, Check Internal Pressure Transducer Connecting Pipe, if Connected then Reject PCB, the Calibration Process will Terminate. Press OK to Continue
OK

Figure 19: Low internal pressure dialogue

Similarly, if the external pressure is low, a dialogue box shown below in figure 20 is displayed advising the user to check relevant parts before rejecting the solenoid. But this is unlikely to happen as the external pressure will have been checked at the solenoid calibration process. If this happens, the pressure transducer block must have been moved.

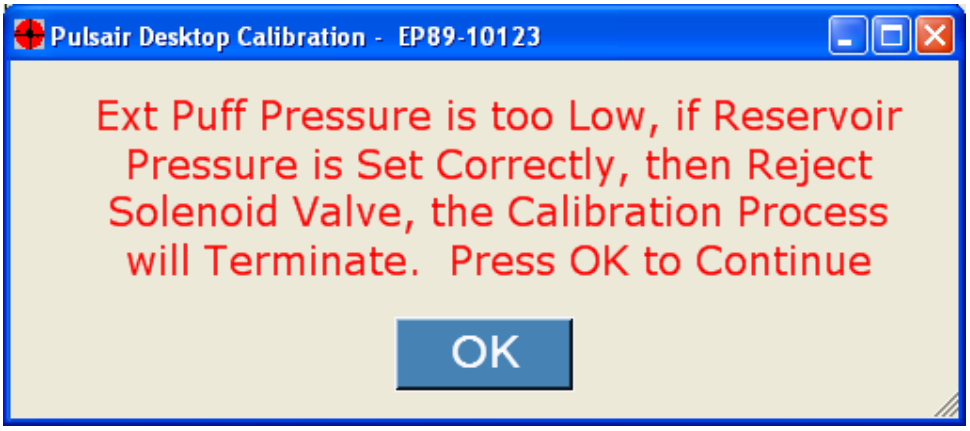

Pulsair Desktop Calibration - EP89-10123
Ext Puff Pressure is too Low, if Reservoir Pressure is Set Correctly, then Reject Solenoid Valve, the Calibration Process will Terminate. Press OK to Continue
OK

Figure 20: Low external pressure dialogue

Op. No. 160

Press Next button in Figure 21 to continue.

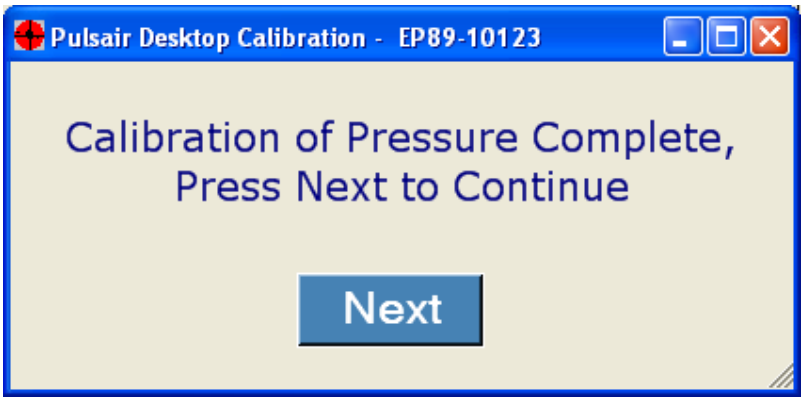
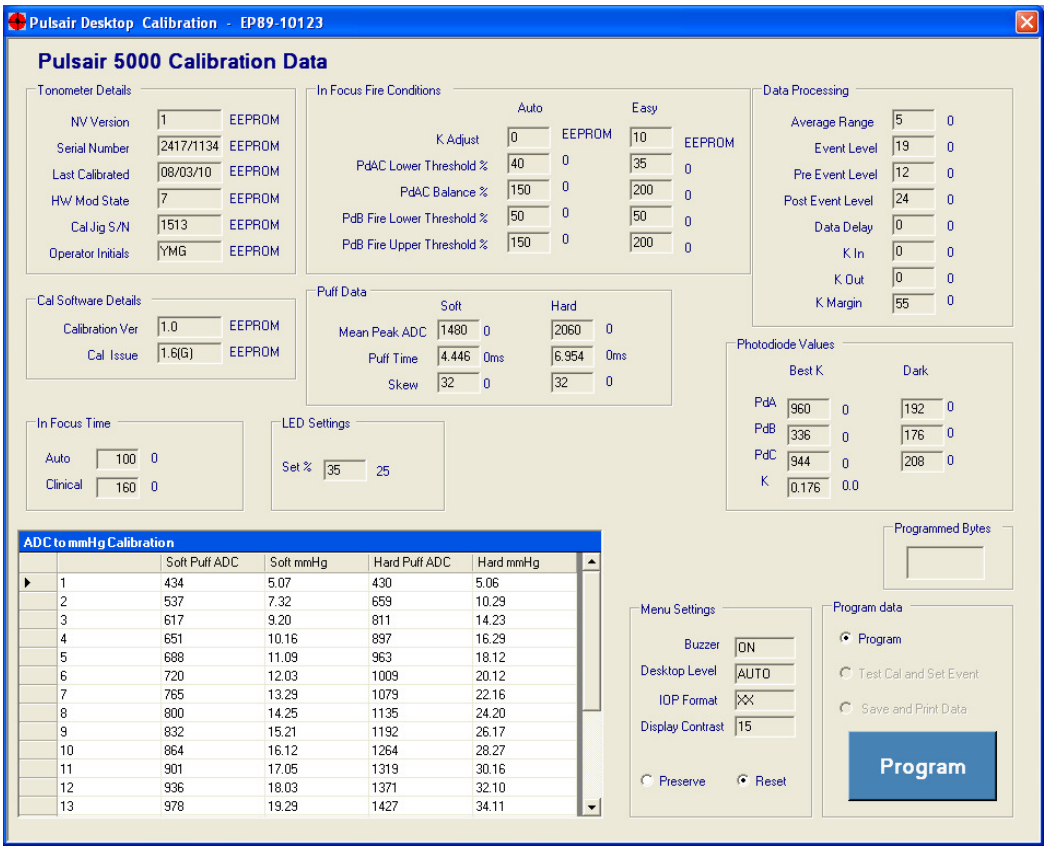


Figure 21: Pressure calibration complete dialogue

Op.No.170

Press Program button in Figure 22 and wait for confirmation that programming is complete. This is indicated by the running counter which turns to lime green when it reached 240.


Pulsair Desktop Calibration - EP89-10123
Pulsair 5000 Calibration Data
Tonometer Details
NV Version 1 EEPROM
Serial Number 2417/1134 EEPROM
Last Calibrated 08/03/10 EEPROM
HW Mod State 7 EEPROM
Cal Jig S/N 1513 EEPROM
Operator Initials YMG EEPROM
In Focus Fire Conditions
Auto Easy
K Adjust 0 EEPROM 10 EEPROM
PdAC Lower Threshold % 40 0 35 0
PdAC Balance % 150 0 200 0
PdB Fire Lower Threshold % 50 0 50 0
PdB Fire Upper Threshold % 150 0 200 0
Data Processing
Average Range 5 0
Event Level 19 0
Pre Event Level 12 0
Post Event Level 24 0
Data Delay 0 0
K In 0 0
K Out 0 0
K Margin 55 0
Cal Software Details
Calibration Ver 1.0 EEPROM
Cal Issue 1.6(G) EEPROM
Puff Data
Soft Hard
Mean Peak ADC 1480 0 2060 0
Puff Time 4.446 0ms 6.954 0ms
Skew 32 0 32 0
Photodiode Values
Best K Dark
PdA 960 0 192 0
PdB 336 0 176 0
PdC 944 0 208 0
K 0.176 0.0
In Focus Time
Auto 100 0
Clinical 160 0
LED Settings
Set % 35 25
ADC to mmHg Calibration
Soft Puff ADC Soft mmHg Hard Puff ADC Hard mmHg
1 434 5.07 430 5.06
2 537 7.32 659 10.29
3 617 9.20 811 14.23
4 651 10.16 897 16.29
5 688 11.09 963 18.12
6 720 12.03 1009 20.12
7 765 13.29 1079 22.16
8 800 14.25 1135 24.20
9 832 15.21 1192 26.17
10 864 16.12 1264 28.27
11 901 17.05 1319 30.16
12 936 18.03 1371 32.10
13 978 19.29 1427 34.11
Programmed Bytes
Menu Settings
Buzzer ON
Desktop Level AUTO
IOP Format XX
Display Contrast 15
Preserve Reset
Program data
Program
Test Cal and Set Event
Save and Print Data
Program

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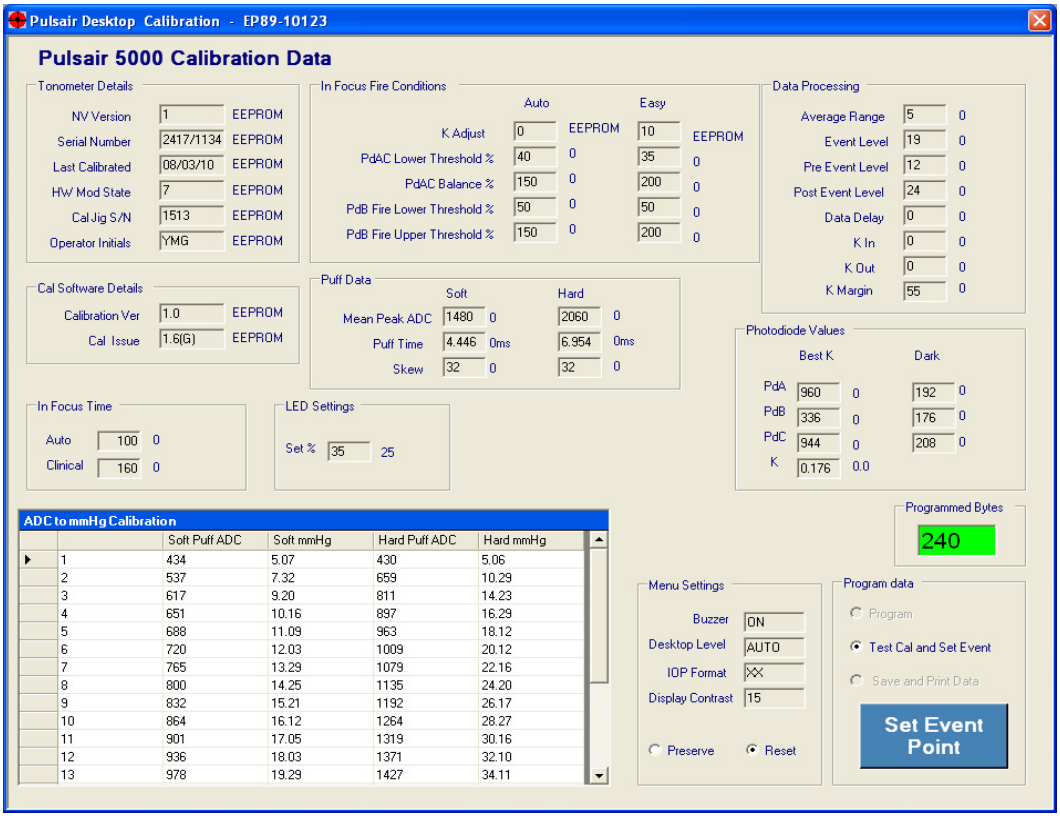
Pulsair Desktop Calibration - EP89-10123
Pulsair 5000 Calibration Data
Tonometer Details
NV Version 1 EEPROM
Serial Number 2417/1134 EEPROM
Last Calibrated 08/03/10 EEPROM
HW Mod State 7 EEPROM
Cal Jig S/N 1513 EEPROM
Operator Initials YMG EEPROM
In Focus Fire Conditions
Auto Easy
K Adjust 0 EEPROM 10 EEPROM
PdAC Lower Threshold % 40 0 35 0
PdAC Balance % 150 0 200 0
PdB Fire Lower Threshold % 50 0 50 0
PdB Fire Upper Threshold % 150 0 200 0
Data Processing
Average Range 5 0
Event Level 19 0
Pre Event Level 12 0
Post Event Level 24 0
Data Delay 0 0
K In 0 0
K Out 0 0
K Margin 55 0
Cal Software Details
Calibration Ver 1.0 EEPROM
Cal Issue 1.6(G) EEPROM
Puff Data
Soft Hard
Mean Peak ADC 1480 0 2060 0
Puff Time 4.446 0ms 6.954 0ms
Skew 32 0 32 0
Photodiode Values
Best K Dark
PdA 960 0 192 0
PdB 336 0 176 0
PdC 944 0 208 0
K 0.176 0.0
In Focus Time
Auto 100 0
Clinical 160 0
LED Settings
Set % 35 25
ADC to mmHg Calibration
Soft Puff ADC Soft mmHg Hard Puff ADC Hard mmHg
1 434 5.07 430 5.06
2 537 7.32 659 10.29
3 617 9.20 811 14.23
4 651 10.16 897 16.29
5 688 11.09 963 18.12
6 720 12.03 1009 20.12
7 765 13.29 1079 22.16
8 800 14.25 1135 24.20
9 832 15.21 1192 26.17
10 864 16.12 1264 28.27
11 901 17.05 1319 30.16
12 936 18.03 1371 32.10
13 978 19.29 1427 34.11
Programmed Bytes
240
Menu Settings
Buzzer ON
Desktop Level AUTO
IOP Format XX
Display Contrast 15
Preserve Reset
Program data
Program
Test Cal and Set Event
Save and Print Data
Set Event Point

Figure 22: Programming data

***Note**: If the programming fails, a message box will inform the user and the EEPROM Bytes text box field will turn red. In this case reject the head unit PCB.*

Op.No.180

After Programming is complete the dialogue shown below in Figure 23 is displayed. Press Next to continue.

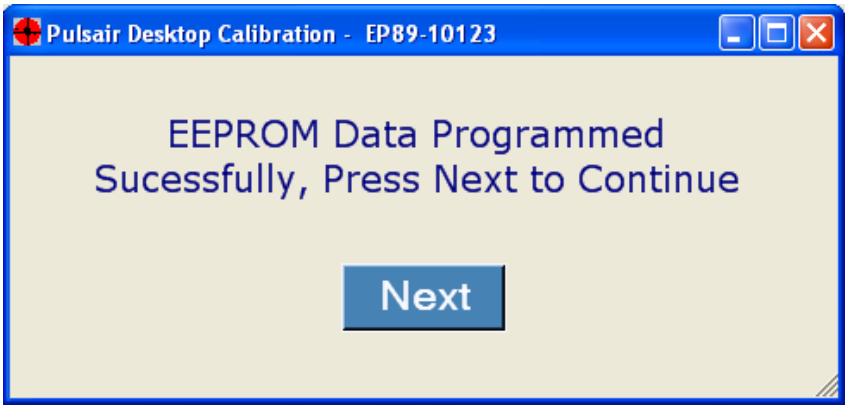

Figure 23: Dialogue showing Programming successful

Op.No.190

After Programming is complete, the Test Cal & Set Event Point option is selected. Press Set Event Point button and the dialogue shown below in Figure 24 will be displayed.

Figure 24: Rubber test eye alignment dialogue

Op.No.200

Position the rubber eye on the alignment Jig with the rubber test eye marked as 'CalRubberEye14 facing the unit under calibration. Press the Start button shown in Figure 25 below and align for best K. At best K, the red background will turn lime green and the Set Event Point button will be activated.

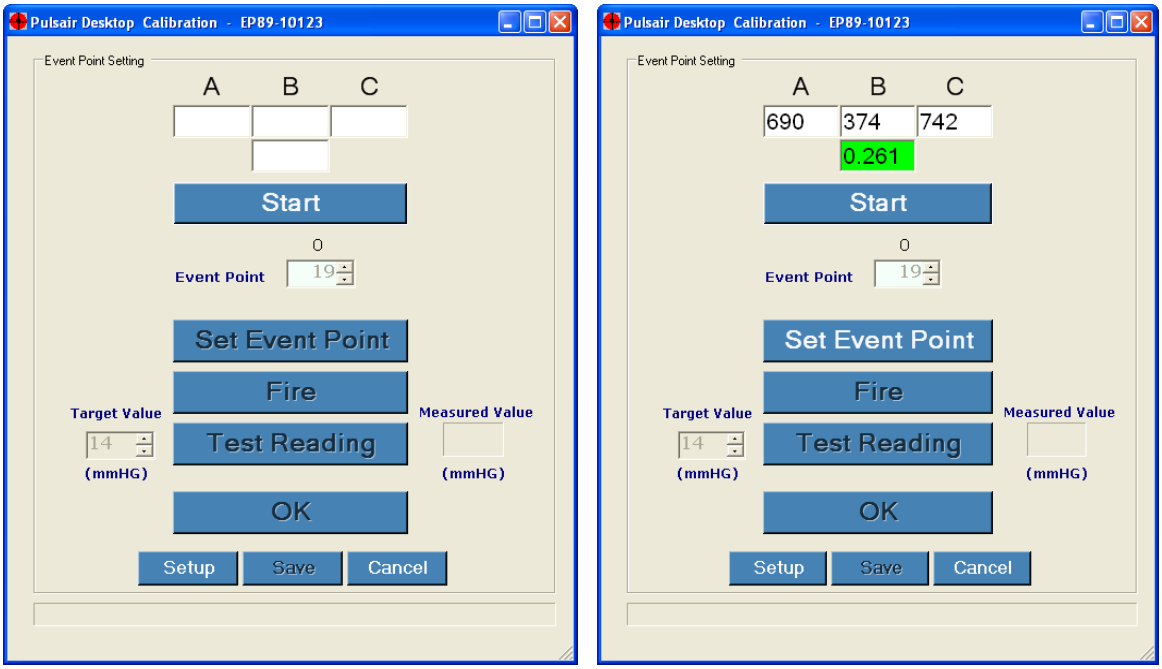

Figure 25: Rubber test eye alignment for best K

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Op.No.210

Once Best K is achieved press Set Event Point button to program the current event point.

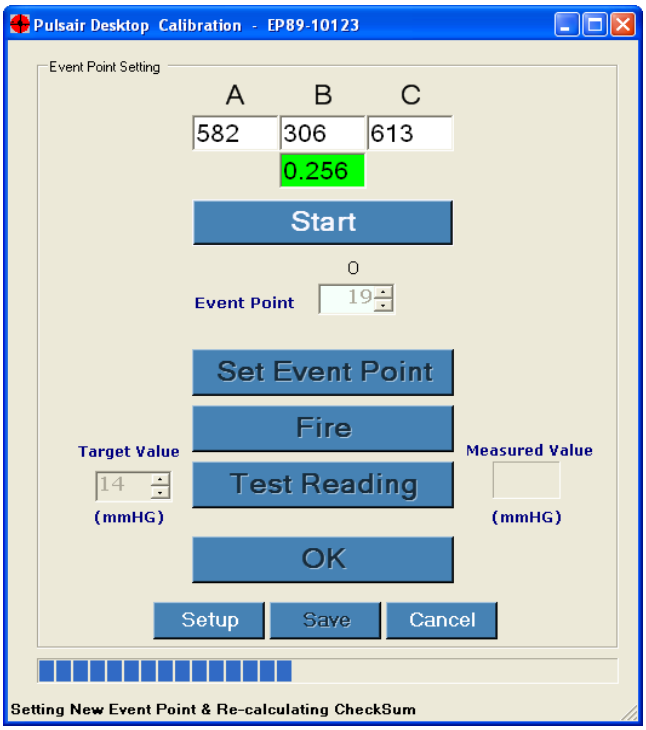


Figure 26: Event point setting

Op.No.220

Press OK to dismiss the dialogue shown in Figure 27 below and press Fire button as shown in Figure 26.

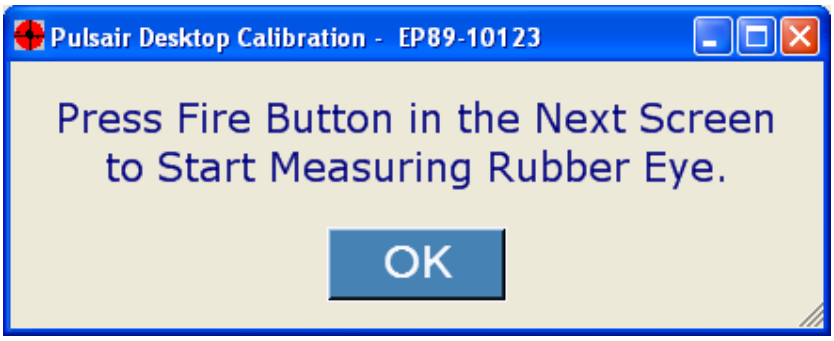


Figure 27: Press fire button dialogue

Op.No.230

Wait for the unit under calibration to fire 4 times and take four readings as indicated in the dialogue in Figure 28 below before pressing OK. The four readings plus the average will be shown on the alphanumeric display.

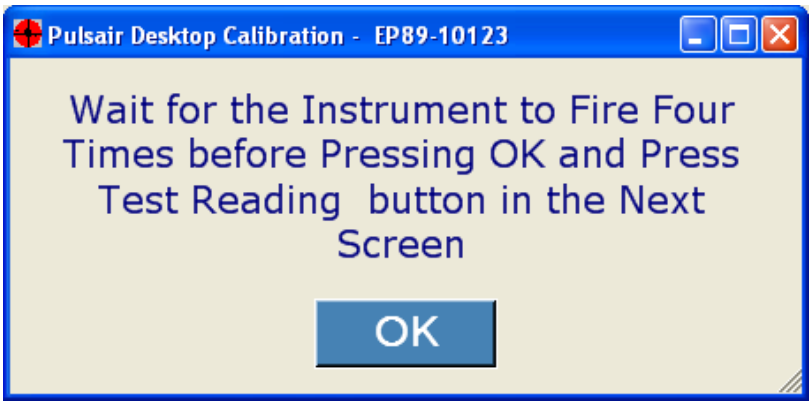

Pulsair Desktop Calibration - EP89-10123
Wait for the Instrument to Fire Four Times before Pressing OK and Press Test Reading button in the Next Screen
OK

Figure 28: Wait until four readings

Op.No.240

Press Test Reading button so that the pressure readings can be compared against target values (in mmHg as shown in the screen). If the reading is outside the target range within ±1mmHg, a new event point is calculated automatically and the user is prompted to press the Set Event Button to repeat the process until the reading is within the target range.

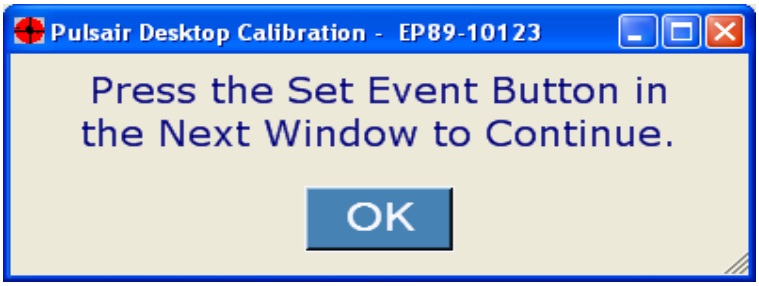
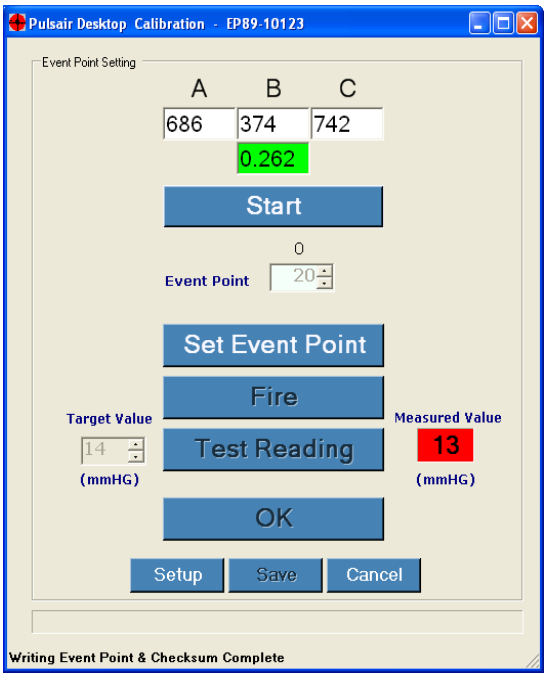


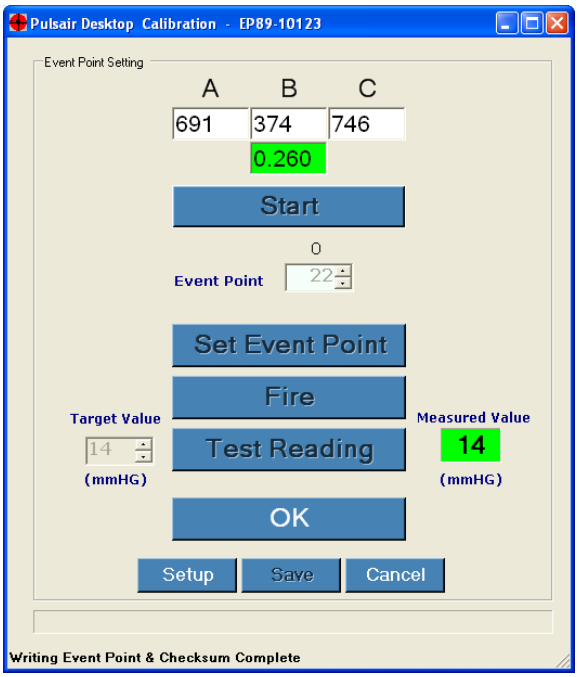
Figure 29: Set event dialogue

Op.No.250

The current average reading is shown in the text box marked as mmHg. If the reading passes the test, the red background (Figure 30a) turns lime green (Figure 30b). Press OK to continue.

Note: *The event setting is an iterative process, and the user is prompted to carry out the sequence of events: Set Event Point ->Fire->Test Reading until the target value and measured value are within 1mmHg of each other.*





(a) (b)

Figure 30: Test reading form

Note: ***The Setup and Save buttons in figure 30 above are used ONLY in the event of changing the rubber eye or setting up the calibration software in new computer. Pressing the Setup buttons prompts the user to enter a password. Once the correct password is entered in the dialogue box (see the on screen hint), the Target Value up/down numeric is activated enabling the user to change the number in mmHG. Once changed on the screen the user should Press the Save button to save the new rubber eye value to the registry for calibration use. The cancel button dismisses the event point setting process and returns the user to the being of the calibration process.***

Op.No.260

Press OK in the dialogue below to continue the process.

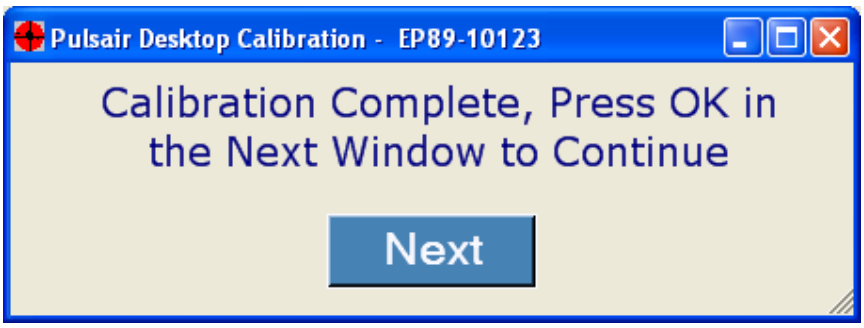


Figure 31: Dialogue indicating the completion of the calibration process.

Op.No.270

Press the Save & Print button to save & print the current calibration data. The data is saved in **'C:\Keeler\Pulsair\Desktop\Calibration data\tonometer serial no.txt'. Note that the Pulsair** tonometer serial number used as a file name.

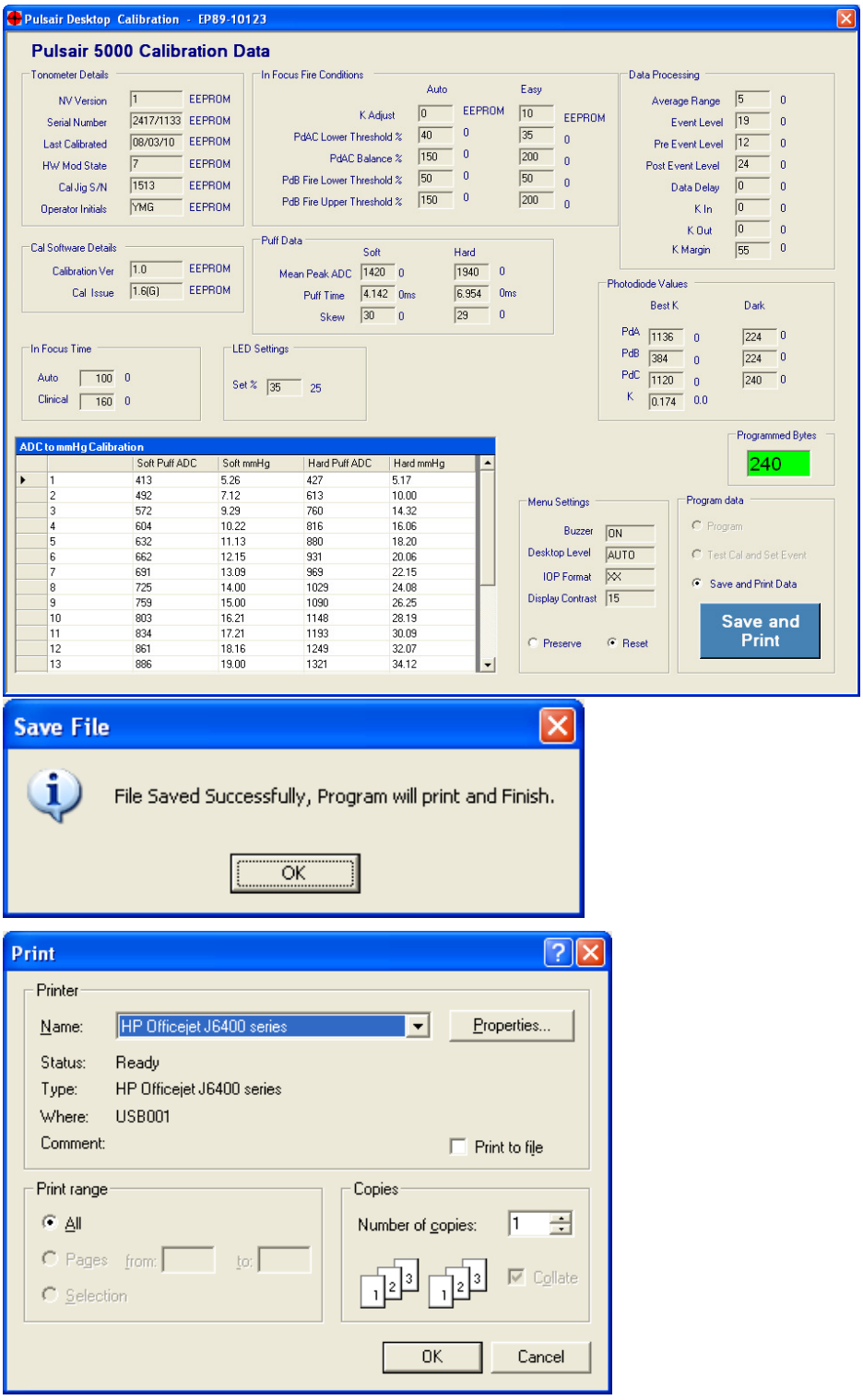


Figure 32: Saving calibration data and print.

Op.No.280

Press OK button (Figure 32) to print the calibration data complete the calibration before returning to the Mode selection form.

Op.No.290

Press the Exit button shown in Figure 33 to finish calibrating the unit under test. At this point the unit will reset itself and will fire and take readings if the rubber eye is still in position.

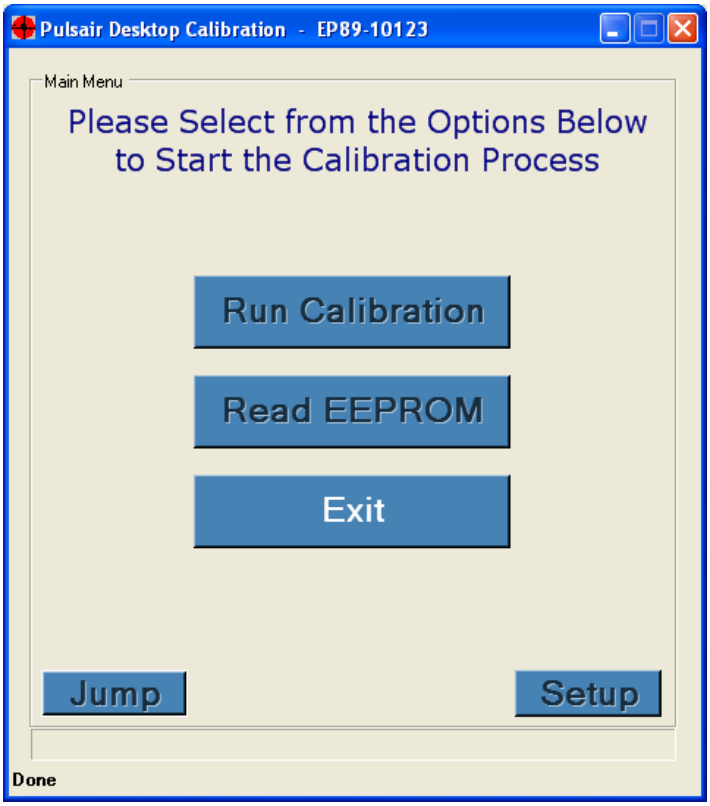


Figure 33: Exit the calibration process.

Disconnect and remove from Calibration Jig.

Remove 4off Screws/Washers and Alignment Plate TD 786 from Mainframe ready for reuse.

Place Assembly to one side.